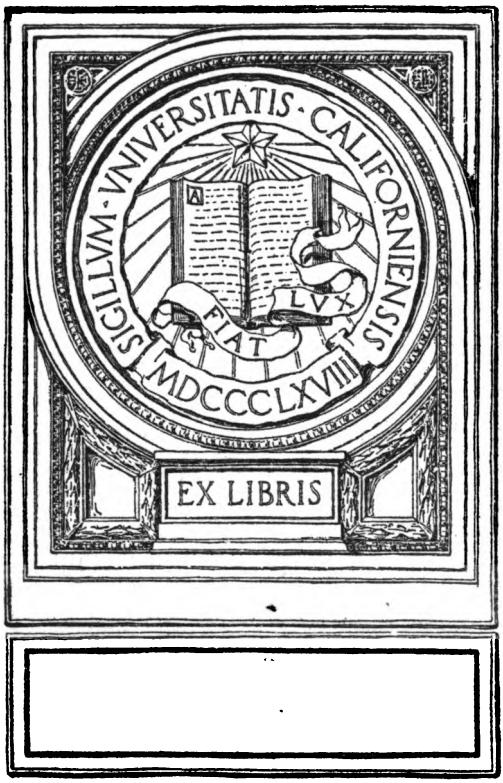
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AUGUST 21, 1824 — JULY 2, 1911

THE NEW METHOD OF EDUCATION

WITH ILLUSTRATIVE EXAMPLES, EXTRACTS FROM SCHOOL DOCUMENTS, AND A CATALOGUE OF THE NORMAL HIGH SCHOOL

By WILLIAM L. WHITTEMORE

With Memorial Address

THE TUFTS COLLEGE PRESS
1911

I OFFER THIS TRIBUTE OF GRATITUDE

TO THE MEMORY OF

LOUIS AGASSIZ

MY FIRST TEACHER IN THE ORDER

OF NATURE

PUBLISHERS' NOTE

The late Professor Alpheus Hyatt and others urged Mr. Whittemore to describe his school-room methods and put them into permanent form. With this desire of his friends in mind, he preserved much written work of many children, and several years ago published in the columns of a local paper the school exercises which, with some changes and additions, now appear as "Illustrative Examples." He published the "Historical Sketch" in the same weekly newspaper, and in 1908 began to reprint these articles, together with certain school documents, under the title of "The New Method of Education."

While this part of the book was in process he was at work upon "General Principles" which he did not live to complete.

OCTOBER 1911.

ADDRESS IN MEMORY OF WILLIAM LEWIS WHITTEMORE AT THE FUNERAL SERVICE IN THE UNITARIAN CHURCH MILFORD, N. H., JULY 5, 1911 BY ALBERT E. PILLSBURY

MEMORIAL ADDRESS

If this is a departure from the usual forms, it is an unusual occasion. William Lewis Whittemore, who disappears from this community with which he has been identified for upward of half a century, was a remarkable character. There is no other like him in the history of the town. He survived the generation that first knew him here, and dwelt for the space of another generation among those who knew him little or not at all. Perhaps he was always best known and beloved among his own pupils. At the desire of some of them who would lay their wreath of remembrance upon his grave, I attempt to speak of him to-day as they knew him.

About three score and ten years ago he came out of the Lyndeborough woods an untutored country lad, endowed by nature with a clairvoyant eye for science and a divine gift of instruction. Few teachers of pronounced genius have appeared in this country, or perhaps in any other. The genius of this man for teaching was as native and certain as the genius of Whittier for song or Powers for sculpture. It was recognized at sight by the greatest teacher, borrowed from Europe, this country ever knew, and the encouragement of Agassiz helped to fix him upon the vocation to which he was unmistakably called.

For his own education he seems to have selected teachers rather than schools. Among them he always spoke of William Russell with particular respect, but the most notable part of his training was at the Lawrence Scientific School of Harvard University, under the personal direction of Agassiz and Horsford. They were so quick to see his merits that they opened to him not only the facilities of the school, but their private laboratories, with their personal assistance and intimacy. He studied the sciences with them, and the science of teaching, before it had occurred to people in general that there is such a science. Drinking at this spring, his thirst for a knowledge of scientific education was only stimulated. It became the object of his life, and he went abroad twenty years later for extended study of the educational systems of Europe.

He first tried his hand as a teacher in the district schools of his own and neighboring towns, and after some years of this apprenticeship he came to Milford in 1855 and took charge of the high school. It was soon after the erection of the School street building, now discredited as the "old brick," but then the wonder of the town. For the next dozen years Milford had, under his tuition, probably the best high school in New Hampshire, and if there has been a better anywhere I have never seen or heard of it.

There are no more competent judges of the merit of the school than the hundreds of his old pupils. They have had half a century, more or less, to prove what it did for them, and they are of one accord that he was the ideal teacher. He was a deep student of nature, especially of natural history and geology to which his tastes inclined, but equally adept and skilful in all branches of instruction. Of his views of scientific education I say nothing, as he has bequeathed them to the public in his own words. It is my purpose only to speak of him as we saw him.

His methods in the school were a revelation then, and I suspect that in most schools they would be a revelation now. They were masterly, but never school-masterly. There was no cramming, no memorizing, no teaching or learning of anything by rote or rule of thumb. The school was a place for the development of the mind. Every pupil had to do his own thinking and give his own reasons. It was of no use to know a fact unless the whole meaning of the fact was known. It was of no use to work out a problem unless every step in the process, every why and wherefore, could be explained. What is the longest river ? The Mississippi. But we could not leave the Mississippi until we knew all about it, its discovery, its traditions, its commerce, its part in the history of the country. What is a straight line ?

The shortest distance between two points. In another school this would be the end of it, but on that straight line he would lay open the whole science of geometry. For text-books he had little respect, and they played but a minor part in his system. He taught from nature, from the fields, the woods, rocks, and streams, the home, the shop, the street, the daily newspaper, from which he used to read and draw us into discussion upon it. I remember that he took occasion of a thunder-shower one afternoon to tell us more about electricity than I have ever learned since in an age of electrical science. He was a master of the neglected art of reading, for which he had every qualification, a rich and resonant voice, perfect utterance, and a soul in tune with the highest themes, and he rarely selected any other. He made the scripture reading with which he used to open the school the most impressive religious service I ever saw. It was usually from the Old Testament, and to hear the tones of majesty in which he would deliver the Ninetieth Psalm or other favorites was like sitting at the feet of David.

Perhaps his example was not less striking or fruitful than his precept. And of this let me say first, in view of the cigarette and cocktail type of school-master which has succeeded him, that there was nothing in his example that could not profitably be followed.

He had none of the fashionable vices that are now thought proper to be sown broadcast by the heads of schools and colleges. Raised a country boy in a backwoods town, little if ever in contact with polished society which did not attract him, he had the manner and the manners, no less than the morals, of a born gentleman, in the only proper sense of that much-perverted term. Native dignity, without a a sign or suggestion of the pompous or pretentious, was a part of him. Even the clothes he wore seemed to be a part of him, and it was an attire rarely seen in a country village then, or anywhere now. None who saw him in his prime will ever forget him. Would that I could sketch the picture as well as I remember it. Tall, lithe, straight as an arrow, quick of step and movement, a stately head, with piercing eyes and coal-black flowing hair and beard, he dressed habitually in faultless silk hat, black frock-coat, silk or velvet waistcoat, grey trousers and patent-leather shoes. These things appear out of place on some men. It did not seem as though Mr. Whittemore could wear anything else. He was the portrait of a gentleman, a figure at which people would have turned to look in the streets of any city in the world.

Like most original thinkers, he was in advance of his time. The people could not follow so fast as he

would lead. Dissensions arose about the school. He was stigmatized as a theorist. There were people who would have called him a crank, if that term had been invented. Some of his innovations were so radical as to attract sharp if ignorant criticism. Finally, various petty discontents were brought together in a movement against him, hardly more creditable in form than in purpose, that resulted in forcing him from the school. Master of his own art, he could not encounter the town-meeting champions, and when the school was dragged into the pit of town politics, he retired from an ungrateful contest in which he would have esteemed victory no better than defeat.

He met the new situation by opening in Milford a private normal school. It was popular and successful, but after a few years he abandoned it to his desire for travel and study in Europe. Returning home after a year's absence, he was called to the charge of various schools and science classes, principally in Boston, and after many years in that field of service he retired from active work some twenty years ago or more, to spend the remainder of his days in this village.

He was never taken at his true value, here or elsewhere. The world never found him out. Doctor of Science by higher authority than the universities, no

college ever claimed his service, or gave him its degree. He was left to comparative obscurity, and his buried talents largely went to waste. It was not wholly the fault of those about him. To those who knew him well there was no more kindly or companionable man or interesting character, but he was by nature and temperament shy and retiring if not reserved. He was too modest for self-assertion, and perhaps too sensitive for successful contact with the world. His tastes were the tastes of the scholar, for study, which leads to seclusion, and in his advancing age the hermit habit grew upon him until his life became almost solitary. He was never a "mixer," much less a "hustler"; indeed in his time these valued products of our own day had not appeared. He always felt the duty of service, but he never would put himself forward. He could easily have been drawn into the public activities for which he had such superior gifts. He had only to be asked, and he was not asked. With an unsurpassed knowledge of schools and educational systems, he was but once, I believe, made a member of the school committee. Familiar with books, and thoroughly understanding the educational and other uses of the public library, he was never placed upon the library board. A few years ago he made the town a generous offer of contribution to a street improvement near his premises, for which there

was a crying need. In return for his public spirit, the town gave him denial and detraction. He bore it in silence and without complaint, but it worked deeply upon his feelings and I do not think he ever recovered from it. Thus did his neighbors and townspeople deal with a man who would have adorned a chair in any college or brought distinction to any community that knew how to utilize him. It is not agreeable to recall these things, but we speak of the dead only for the benefit of the living. Neglect and injustice can hurt him no more. The measure of the public loss will never be taken, but the example stands, for instruction if not for reproof.

Of Mr. Whittemore's religious views I speak with diffidence, but it is customary, and he would have nothing kept back. I suppose that we have all observed a tendency in the clergy, if my friend beside me here will pardon the remark, to make the departed a devout Christian who perhaps was never under suspicion of piety by his nearest friends. It may be a harmless hypocrisy, but standing by the body of our old friend I would make no professions for him dead that he did not make for himself living. He was not what would commonly be accounted a religious man. If he ever was connected with any church, he had no active or visible connection with any in his later years. I think that

all churches and creeds were much alike to him, and I am sure that he had little respect for professions, and none for pretences, of piety. He rarely talked of religion, and I take the absence of lip-service as one evidence, at least, that he had a religious nature. He was a reader of the Bible. He must have felt in his soul the solemn majesty and authority of some of the Hebrew scriptures, and I believe that he accepted the precepts of the New Testament as a perfect moral code for a regenerated world, and tried to make them the guide of his life. He did what the prophet says the Lord required of him, to do justly, love mercy and walk humbly and without guile before God and man. Perhaps his view of outward religion is expressed by the familiar lines in which Pope gave the world a creed to which increasing numbers adhere:

> "For modes of faith let graceless zealots fight;
> His can't be wrong whose life is in the right."

I cannot take leave of my old preceptor without acknowledging my great debt to him. With later experience of two academies, and a college, I can truly say that all I ever learned in schools and was able to keep, or found worth keeping, was learned from him. I see here to-day as many, perhaps, of his old flock as are likely to meet again in this world, and it cannot be unwelcome to them if I express what must be the common feeling, a sense of grateful and

affectionate obligation for the lasting benefits received at his hand. He did not try to educate us. He did better. With deeper insight, he taught us to use our own faculties in educating ourselves, the beginning and the end of real education, and if we have not profited by the lesson it is no fault of the master.

It is the good fortune of the teacher that the stuff in which he works is not of clay, but imperishable. His material is the human mind, the youthful mind, plastic and sensitive, "wax to receive and marble to retain." Every pupil becomes a new center of his influence, taking up his work, perhaps unconsciously, and carrying it out to a wider circle and on to a new age. His harvest is reaped only to be resown and gathered an hundred fold. Such was the happy lot of our old mentor and friend to whom we now bid farewell. So shall he live again, long after his body has mingled with its native dust, as the seed of his sowing blossoms anew and bears fruit in regions which his foot never trod, for those who never heard the sound of his name.

CONTENTS

INTRODUCTION

INTRODUCTION

In 1852 the author was a student in Harvard College, and while working under the direction of Professor Louis Agassiz he became interested in the "new" or scientific method of education. From that time, during nearly forty years, he labored as student and teacher to understand that method better, and to put it into practice in the school room.

The purpose of this book is to state in brief what the author believes to be the principles of the new method of education and to give some idea by examples as to how those principles were applied in his own school.

The last one hundred pages of the book consist of school documents which have been reprinted in order to show through what difficulties the new method of education has been obliged to force its way to the small measure of success it has achieved in our public schools.

People are satisfied with the old ways long after better ways have been discovered and demonstrated, not only in the domain of education, but in every field where progress is possible. As an illustration, the story of the locomotive may be told in a few words.

About the middle of the seventeenth century several men from European Universities and Scientific Soci-

eties combined their efforts to utilize the invention of Hero, made eighteen hundred years before. As Hero could turn a wheel rapidly by steam-power, these men believed that by study and experiment steam could be made to move a system of wheels and machinery and accomplish work. Their success was sufficient to encourage others to take up the work in the eighteenth century, among them James Watt, whose great genius and persistent work for many years gave to the world the modern steam-engine which is to-day doing the work of millions of men.

In the early part of the last century another great genius, George Stephenson of England, added to the work of Watt, and in thirty years of wonderful success, the engine became a powerful locomotive, moving trains of cars from city to city. People who wished to travel could sit comfortably as in any house and travel further in one hour than they had ever been able to go in a long, tedious day. But there was only one in ten thousand who wanted any help from Stephenson. He was hindered in every way and derided by the best people of England for years after he had proved to himself that the power for a locomotive was in his engine.

PART I

GENERAL PRINCIPLES
HISTORICAL SKETCH

GENERAL PRINCIPLES

There are two, and only two, methods of education in the world — the scientific method and the literary method. All variations are easily classified in one or the other of these two methods. The basis of the scientific method, often called the new education, is all nature and all art. The basis of the literary method is books. Books constitute a very important branch of art; hence books are included for all they are worth, in the scientific method. But wherever books are made the basis of education, civilization remains nearly stationary. This has been the condition of China for centuries, and of South America from the earliest European settlements. Books can never yield that kind of knowledge which has transformed European and American civilization during the last two hundred years.

How did this broad wave of mental force which has given us all modern civilization, originate? What are the principles on which it depends, and what are the laws of its progress?

The men who accomplished this work prepared themselves for it by reading a volume ever open to us all, a book in which the letters are suns and worlds, the forces which build the elements into living forms, and all the varied phenomena of nature. They

were such men as Newton, Morse and Watt, and they worked mainly according to the method of the Arabian schools of the seventh to the tenth centuries.

The principles of this method, the scientific method, are few and simple, and so in harmony with the laws of human development, that the youngest child in our schools is delighted in their daily use, and ascends the hill of science and sound learning without weariness, finding every lesson as interesting and healthful as play itself. In accord with these principles the human race has made all its progress.

In the following six or eight pages the attempt is made to suggest in a few instances the application of these principles to the mental development of the child and to the development of the race from barbarism.

The objects which are the most essential to our well-being are those which are the most interesting: the rising and setting sun, the revolving stars and planets, a million species of living things, plant and animal, gems innumerable "of purest ray serene." These objects all remind us that we inhabit a world of cause and effect — a world in which eternal and unchanging laws encircle us, and reign supreme. Since we live in a realm of law, how shall we study and comprehend it?

We must go down into principles — into nature, and proceed at every step in accordance with the

nature of the child. Through the years between infancy and the school age, the child shows us in a decided way the direction in which nature impels him and guides his activities, and hence, the direction in which we ought to help him to go. To the child, the sky, the great blue dome which bends over the landscape, is a real canopy directly over his playgrounds. Here he is delighted all day long in every object of sense — in every novelty of sound, color and form, in every bird, beast and insect, in the beautiful forms and colors of plants and flowers, in the moving clouds; and even the solid earth and sand and pebbles he treads upon — all are objects of interest, objects of study, and of wonder. Here in the realities of the world, so near at hand, are the perfect lessons for intellectual and moral culture, infinite in number and variety, created and perpetually renewed by Infinite Wisdom, for infinite good.

Something of every science and art should be learned by children as soon as they can put it to use. This is the best, if not the only way of making facts permanent and always available. It is the child's nature to observe, and as soon as he can talk he wants to tell every detail of his observation and experience. This oral report seems to be an essential part of his life. He continually brings the words he has learned into use, and this gives him complete success in ex-

pressing his ideas in words. In school the child must soon begin to widen and improve his method by recording the results of observation in writing and drawing. This very soon interests him even more than his oral method, which will still be useful to him.

All nature is a unit, and the science of nature is only one science. The division of science into a dozen branches is right in the advanced stages of education, but in primary and grammar schools it is absurd, and fatal to progress. In all grades below the high school all studies are to be correlated, and learned as one subject. Children are always interested in this work, and they make easy and rapid progress in the arts of reading, spelling, writing, composition, punctution, drawing, and use of capitals, as well as in every branch of science.

Whatever a child learns in school should be organized for his immediate use. Each lesson must involve principles which can be used, and will be used in the child's free activities, in school and out of school. So far as it goes a child's education must always be complete. From the beginning it must be a little system of philosophy for the child's use : and it must be so pleasing and attractive to him, that he will always want to extend and widen it. The government of such a school is very easy ; for children

do not get out of order when their work is more interesting than play.

The basis of a child's education must be his own observation, and not the observation of another who has written a book or a reading lesson for him. He wants original ideas, not second-hand ideas. He is not satisfied with the shadows of ideas which come through words. By oral instruction and reading he may derive interesting and useful information, but information is not education, it is not intellectual power, without which all education is radically defective. True education comes mainly through the inductive method. Every child, in the freedom of nature, intuitively educates himself in this method. He correlates and organizes impressions of all kinds through all the years preceding the school age, and he enters school with his education well begun. He has learned something of every branch of science, and at the same time has learned a language more thoroughly and in less time than the schools have yet been able to teach one. He has learned more of his environment than he will ever learn in school in the same length of time. The reason for his wonderful advance in education in these years of early childhood, is because his method has been natural instead of artificial.

All the great branches of learning should be intro-

duced during the first week of school, not by separate lessons in each, but all combined in nature study. As all parts of the world are interwoven with each other, so are all branches of science intimately connected, and must be presented to the child as a single subject. The time for children to learn the spelling, meaning, and use of words is when they have occasion to use them to express their own original ideas. The same may be said of grammar, arithmetic, and all other branches to be studied before the age of twelve. True education from the first is a many-sided unit, and each side is kept bright by constant use.

Among the popular criticisms upon our schools, there have been complaints of too many branches of study; but really there is but one subject in the true method. It is natural for children to play; but in play they do many different things in a single game. They use the sense of sight, the sense of hearing; they walk, run, jump, talk, laugh and sing. Children's play is made up of many parts, just as a lesson in school has, or ought to have, many parts or kinds of activity.

In the true methods of school work, the teacher must observe the law of nature or his work will be a failure. He must do nothing for the child that the child can do for himself. General information may be derived from books and oral instruction, but these

can never give intellectual and moral power, which are the essential elements of true education. Until the child educates himself by his own efforts, wisely guided by the teacher, he will be very poorly educated.

The study of nature in our schools awakens the child into intellectual life, and establishes in him the love of the beautiful, the true and the good. It enables the teacher to organize all branches of study into one symmetrical science, in which each branch helps to give meaning and interest to all the others. It converts the unnatural and wearing drudgery of the school room into the most delightful and healthful work both for the teacher and the pupils. It gives us health and strength by alluring us into the pure air and varied scenery of the open landscape, for the observation of natural objects and phenomena, and the collection of material for study.

The study of nature enlivens the imagination and awakens the latent energies of the child,—adds strength to his body, variety, activity and vigor to his mind. Besides saving the child from artificial stupidity so commonly produced by the arbitrary methods of the old education, it enables him to learn more in reading, writing, arithmetic and spelling in one week, than he can learn in a month in the common method.

In our search for true methods in education we

find perfect models in nature's method of educating the human race in its first steps in civilization. Nature does absolutely nothing for man that he can possibly do for himself; but the infinite sources of light and truth, with all their beauties and harmonies, are ever all about him, to educate him, to elevate his thoughts and help him to attain to wisdom.

There was a time when our ancestors saw nothing around them but wild nature. There was no art. There were no tools of any kind to assist the savage in making a beginning in art. He had within him the germ of all art — the germ of all science; but without the stimulus of environment that germ could no more expand and raise him out of his savage state, than the acorn can become the stately oak without the light and heat of the sun.

The awakening of man's dormant faculties into activity is and always has been the one condition of his improvement. Nature's laboratories were in full operation preparing for the coming of man long ages before his advent. Although the primitive man was ignorant of everything over head, around him, and under foot, the crust of the earth was a great storehouse of perfect material for the architect, the sculptor, the painter, the blacksmith, the coppersmith and the goldsmith.

Just as long as man remained ignorant of the

properties of these things, and other products of nature, he was to remain a naked savage, sharing the world equally with the wild and hungry beasts that howled around him. He was at liberty to wait a thousand years, or a thousand centuries. Houses to protect him by night from the lion and the tiger, and from the cold storm, would not spring up out of the ground for him. Nor would clothing or needles and thread, nor tools for the architect grow on trees. Nature had done all that ought to be done, and could wait for man to join his work with hers. Then, and not till then, could the arts have even the rudest beginning. This was the one condition of progress, and is to-day the one condition of progressive civilization.

In the last analysis, man's observation in nature, or what we call nature study, is the sure and only foundation and source of all civilization, the source of all science, all art. The savage who first observed that rocks are brittle, and can be broken down to a cutting edge, was the father of all sculptors. His stone hatchet, so useful at that time, is of no value now except as a curiosity and a help in the study of archaeology. We can hardly realize how rude were the beginnings of all man's grandest achievements.

Architecture is one of the oldest and most important of the arts. Through innumerable little improve-

ments at long intervals, it has reached a good degree of excellence, and it is improving faster than ever.

The barbarian who built the first house finished it in one day. With a modern axe he could have done it in one hour; but his axe was only a sharp stone, and he used his hand and arm for the handle.

The primitive house had a ridge-pole, and that is the only part of it that has come down to our time. Each end of the pole rested on the branch of a tree, and for the walls of the house small evergreen trees stood leaning toward each other and the pole. The builder was well pleased with his house and thought it was perfect. But on a cold morning a month later the children were found covered with snow which had sifted through in the high wind. This set the architect to thinking how to improve his house and keep his family dry and warm. At last the way to do it dawned upon him, and soon he was bringing hemlock boughs to weave thick into the walls. For a while the house was again thought to be perfect. But on a very cold day a fire was needed, and the dry resinous boughs were soon in flames.

The next plan was a fire-proof house. Rocks were piled one upon another for the walls; but open spaces between them let in the cold air and snow. A happy thought the next rainy day resulted in plastering the house with mud. Soon as the mud was dry it crumbled away and left the walls as they were before.

After some study and experimenting with mud from several places a sample was found which contained a little clay mixed with the sand, and this became so hard and firm on drying that it lasted a long time.

These little occasional improvements of many kinds continued for centuries, slowly improving the house, increasing the cost, and making the architect's work more complex.

Thus it has been with every branch of art and science from the rudest beginning, and thus it will continue, for every branch is progressive.

HISTORICAL SKETCH

The most wonderful of all civilizations that have yet appeared in the world is that of Greece. The Greeks not only originated nearly all branches of science and art on which modern civilization rests, but they discovered the methods which have made real progress in education possible. More than two thousand years ago the science of education was the culmination of their glory. At that time the school-masters were considered the true luminaries of the world, and they were honored above all other men. Only the brightest intellects, the most learned, the wisest and best men could become teachers.

About six hundred years before Christ the philosophy of the Greeks was becoming more philosophic. Each generation was correcting the errors of the past, and civilization was reaching a higher standard. Three men of learning and genius, Solon, the Lawgiver, Thales and Pythagoras, philosophers and teachers, appeared at the same time. They gave their energies to the cause of education and philanthropy. The disciples of these wise men became the teachers of Socrates; Socrates was the teacher of Plato; Plato was the teacher of Aristotle; Aristotle was the teacher of Alexander the Great, and the first to illustrate all the principles of the new education.

With Solon, Thales, and Pythagoras, came the dawn of Greek science, which culminated in Theophrastus, Aristotle, Archimedes and the Athenian and Alexandrian schools. Thus, three hundred years of unparalleled progress had established in Athens, and in Alexandria, the educational methods found in the best schools of Europe and America at the present time. In many things the noted Greek teachers all differed; but all agreed that real philosophy comes to us through the diligent search after wisdom in the book of nature; and that all men ought to reflect in their lives the image of that order and harmony by which the universe is sustained and regulated.

Theophrastus was the first scientific writer upon botany and mineralogy that the world ever produced. He wrote five volumes upon minerals, and ten upon plants.

Aristotle was the father of zoology. He wrote fifty volumes upon the animal kingdom. Archimedes and Euclid were the greatest of ancient mathematicians, and have never been excelled. Pythagoras, Apollonius, Hipparchus, and Aristarchus explained the solar system as we understand it to-day. But their wisdom was completely smothered in Europe by the long dark ages.

Aristotle was born B. C. 384. He was a pupil of Plato for twenty years in the great school at Athens, and then had charge of the same school. He soon

received a letter from Philip, the King of Macedon, as follows: "Be informed, O Aristotle, that I have a son, and that I am thankful, not so much for his birth, as that he was born in the same age with you; for if you will undertake the charge of his education, I assure myself that he will become worthy of his father, and of the kingdom which he will inherit."

Philip's son was Alexander the Great. Alexander was soon with Aristotle, and remained with him eight years, when he ascended the throne at twenty years of age. During these years Alexander fully appreciated his advantages and made remarkable attainments in all directions. He saw so much to admire in Aristotle's methods that he became, from that time, an enthusiastic patron of learning; and his first act on the throne was to furnish Aristotle with material and all necessary appliances for the illustration of his methods in the school at Athens. To accomplish this without delay, Alexander sent several thousand learned men to all parts of the known world to collect material for the illustration of every science. But to make a model school at Athens was only the beginning of Alexander's influence upon education. Ambitious as a conquerer of nations, he was still more ambitious in making a better civilization for all men.

It was Alexander's ambition to conquer all nations, and combine all nations into one empire whose institutions should all be permeated by the learning and

wisdom of Greece. He was maturing a mighty scheme for collecting all knowledge, for the increase of knowledge, and its diffusion throughout the world. The first move toward carrying out this plan was to invade and overthrow the rich and populous Persian empire. Persia had an area half as large as Europe, and next to Greece, was the most learned and cultured part of the world. It included all that remained of the older civilizations of Babylon, Egypt, Assyria, Chaldea, and Mesopotamia. The largest armies ever led to battle had been the Persian armies under Xerxes and Darius for the invasion of Greece.

In the spring of 334 B. C., Alexander, with an army of only 40,000 men, crossed the Hellespont, and entered the Persian empire. Slowly he moved toward Egypt, conquered every city on the way, and defeated the army of Darius numbering 700,000 men. While in Egypt he founded the city of Alexandria, which he designed for the educational metropolis of the world. Soon after this Alexander renewed his march toward other great cities of Persia. After crossing the Euphrates he again defeated the army of Darius, numbering a million men. The gates of many opulent cities, with all their treasures, were now open to the Greeks. Thence, the victorious army marched easterly to the Ganges river, conquered all that remained of Persia, invaded India, defeated King Porus, and took possession of thirty cities of India.

Of all military campaigns, this was the most remarkable, both in its purposes and its results. To thousands of learned Greeks the march through Persia was much more than a military campaign. It was a thorough scientific study of the country through which they marched. At times it was like a grand excursion for sightseeing, recreation, and scientific observation, over a large, rich and populous country, abounding in the wonderful in nature and art.

As soon as Alexander had conquered Egypt and the better half of Asia, he prepared to continue his march to the shores of the Pacific and take possession of all Asia in a single campaign. But his army had left their homes eight years before, and refused to march any farther except toward their native land.

Alexander yielded to the wishes of his faithful warriors and soon returned to Babylon, which he intended to make the capital of the prospective new empire. In the midst of great plans for the reconstruction of his vast dominions, the completion of his educational plans, and the future conquest of the rest of the world, came Alexander's death, in the thirty-third year of his age.

The result of Alexander's conquests in Asia and Africa we are to consider only in its educational influence. But the grandest movement in education that the world has ever seen had already been formulated. Alexander had made Ptolemy the governor of

Egypt, to have control of the educational interests of the world. On the death of Alexander, Ptolemy became king of Egypt. For carrying out the plan of Alexander, Ptolemy had in his treasury $400,000,000 in gold and silver.

The magnificence of the buildings reared for the Alexandrian school I will not attempt to describe. They were built by the greatest architects of Greece, and adorned by the greatest sculptors the world has ever known. Surrounding these buildings were botanical gardens, filled with the living representatives of the flora of all nations; zoological gardens representing the living forms of the land and the sea; great temples filled with paintings, sculpture, and every art of the known world. Still more important than these was the library of 700,000 volumes, by far the largest library of antiquity. In short everything was done that could help to make a school for the collection of all knowledge, for the increase of knowledge by scientific investigation, and the diffusion of knowledge throughout the world. Under the reign of the Ptolemies the Alexandrian school continued about three hundred years, until Egypt became a Roman province. During this time it had reached its greatest excellence. The students were from all parts of the world, and the average number for three centuries had been twelve thousand.

Under Roman dominion the school was not kept

up to the high standard of its illustrious founders, or the luxury and indolence of the East had taken the place of the love of learning. But the methods of that school had been carried by its patrons to various parts of the world, and had taken root in many a school in Arabia and Persia and in Europe. But the long dark ages, that followed the downfall of the Roman empire, blotted out of all Europe nearly every trace of the intellectual light that had originated in the Greek civilization. But in Asia, where Alexander a thousand years before had collected the gold to establish the great school, the science of the Greeks had been kept alive, and under its influence the Arabians and Syrians became a progressive people. Before the ninth century they had excelled in learning all the nations of the world at that time, and they held that position for many centuries.

Although Alexandria was partly destroyed, and what Caesar had left of the great library was burned, the ultimate effect of the Arabian wars of conquest in the seventh century was to stimulate intellectual activity, and greatly accelerate the progress of sound learning. For the conquering armies, after they had well-nigh destroyed the results of Greek learning and culture, as they saw the ruined palaces, adorned with every art, as they thought of the half million rare books which they had destroyed, they became more thoughtful, and repented of their wanton destruction

of the very source of all the splendor of the ruins that surrounded them. They soon began to cultivate the civilization of the conquered people, and restore to the world what they had destroyed. Books were collected at great expense from all sources, and translated into Arabic. Schools and colleges sprang up, and learning revived in every part of the great empire.

In the early part of the eighth century a Spanish noble requested Musa, the governor of Egypt, to send a military force to Spain to correct the tyranny of King Roderic, the usurper. Seven thousand men led by the brave general Tarik soon landed at Gibraltar, and in two years had taken nearly all Spain. Tarik established in Spain the best known civilization, giving all Europe the means of rising above the thraldom of ignorance and barbarism, and eventually bringing the dark ages to a close. From time to time thousands of the cultured families of western Asia and northern Africa were attracted to Spain by the genial climate, beautiful scenery, and fertile soil. Schools, colleges and universities were founded in the Alexandrian methods. A high civilization sprang up and flourished for nearly eight centuries. It became the best civilization in the world at that time. It held that position until Europe had founded, on the Arabian models, learned societies and academies in every capital and large city.

The most enlightened artisans of Asia were induced to settle in Spain and introduce the arts of civilized life. The improved productive arts soon brought the comforts, conveniences and necessities of life within the reach of all. The decorative arts furnished ornaments and elegance in dress and furniture. Spain became the garden and market place of Europe. The neat, polite and well-dressed people made a striking contrast with merchants from France, Germany and England, dressed in sheepskin or the untanned hides of other animals.

The wealth, learning, elegance and refinement of Spain, nearly equaled that of the best parts of Europe at the present time. Cordova, the capital of Andalusia in the tenth century, had a population of a million. They had a library of 600,000 volumes. Seville, Toledo, Grenada and sixty other cities and towns each had a large library, some of them rivaling that of Cordova.

Here, after a precarious existence for centuries, was the beginning in Europe of that modernized Greek civilization which was to spread over the entire continent. One man in ten thousand saw the promise of better days for Europe from this source, and sent his sons to the Cordovan schools. Every student on returning home became the nucleus of a secret society for the promotion of learning. Men of worthy motives and independent judgment began to increase in all

the populous centres. But there was no safety for such men till the seventeenth century. Still the work went on with increasing numbers and greater boldness. Learned societies were established on a larger scale, and more openly. The intellectual element had become uncontrollable.

The *Academia Secretorum Naturæ* was founded at Naples in 1560; the Lyncean Academy in Rome, 1603; the Royal Society, London, 1645; the *Accademia del Cimento*, Florence, 1657; Royal Academy of Sciences, Paris, 1666. These and many other learned societies were all organized on the Greek models. Only the Greek methods have ever produced such men as Copernicus, Galileo, Kepler, Newton, Napier, and Lavoisier. These and other illustrious names were the peers of Archimedes, Ptolemy, Apollonius, Euclid, Aristotle, and Hero.

Historians have never given due credit to the Arabians for what they did in the darkest part of the dark ages to save the results of Greek civilization from oblivion. National vanity and a difference in race and religion explain their treatment in Christian Europe. But their religion led them to be temperate in all things, tolerant, kind and true to all men. It led them to cultivate neatness, elegance, courage, chivalry, justice, and personal honor. But all Europe combined to destroy them. Each century diminished the Arabian territory, and what could not be done by

war, was done at last by the fires of the inquisition — the most cruel device to stifle liberty ever organized by barbarians, or by half civilized fanatics. Thus perished millions of Arabs, Moors and Jews, after having been a model for European progress from the earliest efforts of Europe to rise out of the darkness of the middle ages.

Four hundred years ago there was not a newspaper nor a common school in all Europe. In the best parts of Europe only one person in a thousand could read and write. In other parts, including England and all northern Europe, not one in ten thousand could either read or write. Very few people cared to know these useful arts which all civilized nations now consider so essential. The first permanent newspaper in Europe was published in Italy soon after the middle of the sixteenth century. Seventy years later the "Gazette de France" was published in Paris. The newspaper followed close upon the common school. Our English ancestors had neither of them till the middle of the seventeenth century. The art of printing, the common school, and the newspaper, in a general way mark the end of the dark ages which ruled over Europe more than a thousand years.

We can hardly realize the condition of our ancestors three hundred years ago. Their houses were built of sticks and reeds covered over with mud. There was no chimney to carry out the smoke, and no glass

to admit the light. Their tables and chairs were logs of wood set on end. Their beds were bags of straw seldom renewed, and a log for a pillow. Their clothing was made of leather or the untanned hides of animals, with no underclothing. Their food was chiefly beans, peas, fern roots and the bark of trees. Their houses and door-yards were filthy beyond expression. Only one child in four lived to be twenty. There were no sanitary conditions anywhere. The population was constantly thinned by pestilence, want, and the most appalling barbarities. The church was an organ for extorting money, and the clergy were the most criminal class of people.

The ignorance, superstition and anarchy that ruled in Europe through the middle ages were not quite but almost universal. A few thousand families, scattered here and there over Europe, lived from generation to generation in a civilized way as far as it was possible in the midst of conditions worse than barbarian. They remembered the achievements of their ancestors in the ancient empires that had passed away, and through their own efforts they had long hoped to see the dawn of a new civilization for the future of Europe. Five centuries of anarchy, war and confusion had been endured, with no change except increasing violence and barbarism.

In the tenth century a ray of intellectual light appeared in the south-west of Europe but it served at

first only to make the surrounding darkness more apparent.

A foreign race had settled in Spain in the eighth century, and had established great universities for the promotion of science and civilization. They had made Gibraltar the stronghold, not only of military power, but of intellectual and moral force. Here they built a line of colleges and universities, extending from Gibraltar a hundred miles toward the Pyrenees, and opened their doors to the young men of all nations. Practically, the Alexandrian school of the Ptolemies had been reconstructed by the learned men of Arabia, Syria, Asia Minor, and Egypt, and carried into Spain. They had restored the great Alexandrian library so far as possible, and transferred it to Cordova, the Spanish capital.

The glimmering of light, radiating in the tenth century from the Arabian schools in Spain where the best families in Europe were educating their sons, hardly seemed like the dawn of a new civilization for all Europe, but such it is proving to be, not only for Europe but for America, and eventually the whole world; for some parts of Asia and South America are already under way in the new education. From the tenth century to the fifteenth, the schools of Spain attracted young men from all parts of Europe. On completing their studies they carried to their homes the spirit of the Spanish Arabian schools, which was

at that time the spirit of the "new education". In the course of time these men began to organize for educational purposes, France, Italy, and Germany taking the lead. Academies of art and science sprang up, only to be closed by the ecclesiastical power. Men who wished to pursue science must do it in solitude and silence, if they would escape the cruelties of that ignorant and intolerant age. But the time came when the light of science could no longer be smothered, for it had been kindled in too many places, and the darkness of the middle ages must disappear. From Spain an influence had gone forth over Europe that the fires of the inquisition could not destroy. The astronomy of Pythagoras had been revived in Arabia and was silently taking deep root in Europe. In the interest of commerce, sailors and merchants were secretly consulting astronomers as to the size and shape of the earth, and a better passage to India. Intellectual activity was increasing in every part of Europe. The spirit of individualism and adventure had been awakened by the three great voyages.

People were eager to hear the news of the day, the wonders of science, the stories of the new world, of the mountains of gold in Peru, and of silver in Mexico.

The two impulses, the intellectual and the moral combined, which finally brought the dark ages to an end, did not spring up at once. Both were germinat-

ing in the ninth century. Both were annually reinforced and enlivened by the exodus of a thousand young men from the Arabian schools. Both impulses were taking deeper and deeper root in the nations of Europe six hundred years before they culminated in establishing the principles of modern European life. Thus the spirit of improvement which had its beginning in the schools of Spain in the darkest part of the dark ages was the cause of the common school and not the consequence of it, as many have supposed.

The common school had its beginning in southern Europe in the sixteenth century, and in the northerly parts a hundred years later. What learning there was at that time, except that derived from the Arabian schools, was confined to bishops, monks and other ecclesiastics. Men who knew the methods of true education could have no voice or influence in organizing the school, or formulating its methods. The schools at first were reading schools and nothing more. The priest of the parish was the teacher because nobody else could read. But when a generation of readers had grown up, any one who could do the necessary flogging could teach school.

The expectations of the reading schools have never been realized. At the end of the sixteenth century there was disappointment everywhere. In the next century arithmetic and writing were introduced, but at the close of the century the disappointment was no

less than it had been a hundred years earlier. Before the middle of the eighteenth century many people became out-spoken in their criticisms of the schools. They claimed that the method must be radically wrong, for in two centuries the public school had done but little toward raising the people out of their ignorance and degradation.

The first of the noted writers on this subject was Rousseau in France. In 1749 he wrote that the children learn nothing but words and no real knowledge, that books rob a boy of his mother wit and he becomes a machine and a dunce. He said that what real knowledge a child receives comes through the senses, which are the basis of the intellectual, and that books are useless until the child is ten years old.

The next distinguished advocate of better methods in education was Henry Pestalozzi of Switzerland. He opened his first school at Neuhof in 1775. Pestalozzi rejected as worse than useless the book learning which prevailed in all public schools at that time. He said that a man who has only book learning is less susceptible to truth than a savage.

For nearly a hundred years Germany has been the educational centre of the world. She is exerting a great and increasing influence in all the progressive and most highly civilized nations, by illustrating the true or at least the best known methods of educating a child. It becomes us, then, to inquire how Germany

has gained the intellectual lead of the world, and how we may put German wisdom into our own schools.

During the first few years of the last century Europe was shaken to its centre by the repeated victories of the French and allied armies under the lead of Napoleon Bonaparte. Upon the defeat of the Germans in the battle of Jena, in 1806, and the entrance of Napoleon into Berlin a few days later, the despair of Germany was complete. The last days of that year found all Germany without one ray of hope for the future of their country. But in the early part of 1807 it began to be manifest that national vitality was still there; and it soon began to show itself in a spirited manner in the management of such social affairs as Napoleon still allowed them to control. It was during this period of subjugation and despair that a few of the ablest and best patriots were already devising the means of national reconstruction. They had lost all hope of immediately improving their condition. Their hope of ultimate success was in armies stronger physically, stronger intellectually and morrally: men who could utilize all their strength through an educated will. In allowing Germany to control her own educational interests Napoleon struck a chord that has never ceased to vibrate.

In a public lecture at Berlin in 1807, the noted philosopher Fichte used these words: "That we are no longer able to offer an active resistance is obvious

to every one. How then can we regain and defend our national existence? In no other way than by raising up a worthy posterity. There remains for us no sphere in which we can act as an independent state, except that of education. And I have only this hope to live for, that I shall convince some Germans that it is education alone which can save us from all the evils by which we are oppressed." At this lecture were high officers of state, kings, queens, princes, ministers of education, and noted teachers to represent the new education, then in its infancy in the public schools of modern Europe. The applause of the great audience became enthusiastic as the philosopher promised not only deliverance to Germany through national education, but declared that it would result, in the end, in the emancipation and reformation of the entire human race.

To the question whether there is any known method of human development sufficient for such a result, the lecturer said there is; "a method which had been invented by Henry Pestalozzi, which is now successfully carried out under his direction, at Yverdon, in Switzerland." As this method of eventual deliverance through education was clearly set forth and fortified by argument, it took strong hold of the public mind. It seems that several other distinguished men had already been thinking of the new education as the surest foundation of national strength, and the true palladium of liberty.

Soon after this meeting in Berlin, Nicholovius, the Prussian minister of education, wrote to Pestalozzi as follows: "At last my venerable, unforgotten friend, I have the pleasure of seeing some rays of thy light penetrate into the schools of my fatherland. What I have dreamed at thy side, what we have discussed in letters, will soon become realized as a work of absolute necessity. With us the march of events has ruined everything, yet courageous men are already bent upon reconstruction. Oh help us to foster the work which thou hast founded. May thy life be spared in order to complete thy work as far as possible."

Carl Ritter, soon after a visit to Pestalozzi's school, wrote to him thus: "I cannot tear myself away from the mountain scenery of Helvetia without devoting to thee, O Father Pestalozzi a silent tear. May it tell how deeply I feel what thou art to humanity. How could I ever forget the time I have spent amidst thy new creations. Even had I gained nothing by it but a renewed faith in humanity, I would consider myself amply repaid.

"My ardent desire to see the champion and martyr for truth and love, and to be refreshed at the living source of his life and example, has been granted; and I return with enlarged feeling into this cold vortex of life. I thank thee venerable father, for thy affection. It has taught me a warmer and purer love: It has strengthened my arm for the struggle with the

world, which every one, to whom life is more than death must undergo. But blind humanity passes by the law of nature, until a Newton shows its application in mathematical science, a Lavoisier through the maze of experimental philosophy, and a Pestalozzi in the wider field of human development."

In 1808 the Prussian government sent twelve well educated and carefully selected young men to Yverdon, to learn the details of Pestalozzi's principles and methods. Nicholovius said to them: "The object of sending you to Pestalozzi is not merely that you may study the external or formal part of his system, but that you may warm yourselves at the sacred fire which is glowing in the bosom of that man, who is full of power and love; that you may walk with a similar spirit in the path of truth, and in the observation of nature; that you may become simple as children in order to obtain the key with which to open the sacred temple of childhood; that you may learn to simplify the elementary part of each science by leading the child directly into the realities of the world through the use of his own faculties, and thus strengthen his mind, by vigorous nourishment, for the application and popular use of knowledge." These students made rapid progress at Yverdon, and on their return they established normal schools which in a few years furnished a large number of earnest and competent teachers. By these and other means the schools of

Germany were organized on a new basis, and a hopeful and vigorous life was felt throughout the land.

In 1813 the allied armies defeated Napoleon in the battle of Leipsic, and Germany was again free. Almost as soon as a generation had grown up in the new education, Germany had occasion for using all the power her armies had gained through its means, to show the world whether there was any reality in her dreams of power to preserve her liberties through an improved method of education.

In 1870 France declared war against Germany. Germany did not hesitate for one hour. Full of life and energy, Germany once more grappled with the great power that had invaded her homes sixty years before. The best-educated army the world has ever seen immediately moved toward the proud capital of France. Two hundred miles from Paris the two great armies met. For the French it was utter defeat in every battle. In a short campaign of seven weeks, the Germans had taken 260,000 prisoners of war, and turned the red battlefields into great cemeteries for the dead soldiers of France. Paris itself was soon invested, and France, which had been the terror of all Europe for a century, was completely broken.

It was to be expected that a method of education originating among German-speaking people, would spread much more rapidly where their language is used than in countries speaking different languages.

Not until 1830 did the government of France make any attempt to introduce the new education, and her public schools had fallen far behind those of Germany. Then a vigorous movement was made in France to raise public instruction to a better standard by the appointment of Victor Cousin as minister of education. He began his work by first making himself acquainted with the best school systems of Europe.

In his report he was emphatic in the statement that the schools of Germany are far superior to all others in Europe. He recommended the immediate reconstruction of the schools of France on the German models. He seemed almost to feel obliged to apologize for studying and recommending the school system of a rival nation. He told France that she ought not to lose the experience of Germany — that national rivalries and antipathies would here be entirely out of place. He farther said: "I am as great an enemy as any one to artificial imitations, but let us not reject a thing because it has been thought good by others. We constantly imitate England in many ways, and to our great advantage. And why should we blush to borrow something from kind, honest, pious, learned Germany, in what regards inward life, and the nurture of the soul."

But the system advocated by Cousin was only partially carried out, and primary education in France has never attained to the standard of Germany.

PART II

ILLUSTRATIVE EXAMPLES

GRADE I.

The First Day in School, and What Was Done by Children Six Years Old.

Song.

Morning's golden light is breaking;
Tints of beauty paint the skies;
Happy song-birds now are waking,
Let their songs to heaven arise.

This is a fine morning to begin your first day in school. After thinking a moment you may tell a few of the interesting things you saw on your way from home.

Bessie — I saw a bird's-nest up very high in a tree.

Helen — I saw a little boy playing in the sand.

Ida — I saw a white rock on the wall.

John — I saw some red clover and some white clover.

Did any of you find out what makes it so light that we can see all these things so nicely? May raise your hand if you can tell what makes it so light every day and so dark every night.

Ida — The sun rises every morning and makes it light.

Does the sun stay in one place after it rises?

May — As soon as the sun rises it goes up higher

and moves along all day in the sky and gets to the place where it sets, and then it gets dark in a little while.

May tell all you know about the sun.

Nina — The sun is round.

Olive — The sun is very bright.

Ella — The sun rises in the east.

John — The sun lights up the world.

Henry — The sun warms the ground and the air.

Edith — When the sun sets it makes the clouds red and yellow.

Jane — The sun makes the sky and the clouds look bright and beautiful.

The sentences above, given orally by the children, were taken for their first lesson in reading.

In the afternoon their reading was selected, as given below: —

"Seas roll to waft me, suns to light me rise,
My footstool earth, my canopy the skies."
— *Pope.*

"The sun rides through the azure sky,
And beams upon us from on high."
— *Romaine.*

"From blue to red, from red to gold, from gold to gray,
So turns the sky, so fades the light, so ends the day."
—*Ermy.*

"The rising sun had newly chased the night,
And purpled o'er the sky with blushing light."
—*Dryden.*

The present approved method of learning to read has resulted from the proper combination of all that is good in every method that has ever been used. No method has been entirely wrong, but the worst of all methods is that which was used almost universally in Europe and America until quite recently, and is still used in many places. It wastes the time and energies of the child on the least important of all the details of learning to read. Under that method, simply the name of each letter was first learned, and that gave no direct clew to the sound of the letters, or the pronunciation of words.

The child must learn to pronounce words at sight by the same general method by which he has learned the looks and name of hundreds of other things which he can name at sight without hesitation. The true order is to observe the whole thing before we investigate the different parts and the smaller details of the parts.

In learning to read the sound of the letter is much more important than its name, but both should have careful attention from the beginning.

Specimens of Work Done Last Part of First Year.

The first move toward explaining the principles of the New Education will be the presentation of a few

samples of work in all the grades, exactly as written by the children while the object described was before them for their inspection. It is hoped that these records will, to some extent, show what modern approved methods are.

School work should begin by learning things near at hand, especially the things that concern people of all ages. Nothing is nearer to us than the air we breathe, the light, heat, and other influences of the sun, the earth we tread upon, and the vegetable world around us. These are the sources of life, health, and true culture. They are the foundation of our industries and our wealth.

The Landscape.

"A landscape is all the land and everything the land contains as far as we can see in all directions. When we are in a valley we can see but a little way, and if we wish to see a large landscape we must go to the top of a high hill or a mountain.

Yesterday we all went to the top of a high hill to see the landscape that surrounds our school. On our way we saw fields of grass and corn, pastures full of sheep and lambs, lawns and gardens, woodland with many kinds of trees, squirrels, birds and butterflies. When we were at the top of the hill we saw the great landscape reaching to the horizon in all directions.

The largest things in the landscape were the mountains in the west and north, and the great hills in the east."

NINA.

THE SKY.

"The sky is the largest sight that we can ever see, and one of the most beautiful of all sights. It seems to be just as broad as the landscape, and it reaches down to the horizon all the way around. The sky looks like a great hollow dome, or canopy perfectly rounded in every part. It contains the blue air that keeps every plant and animal alive, and the beautiful clouds always changing their color and shape. The sun and moon are in the sky a part of the time, and the stars are always there, but we can see them only in the night because they are so far away."

DORA.

THE TRILLIUM PLANT.

We all had a beautiful Trillium plant to study this morning, and we are going to describe it in writing. The Trillium grows about six inches high, and it is a very interesting little plant. The lower part of the stem is pink, and it shades off into light green in the upper part, and dark green at the top.

"The plant has only three leaves and they grow in a whorl near the top. The leaves are large for a little plant like this. They are more than three inches long and half as wide. They have a great many

veinlets growing out of the veins, and they divide the leaf into little parts of many funny shapes. The leaves are ovate, and they have an entire margin and a sharp point at the apex.

"The Trillium has but one flower, but it is large and beautiful. The flower has three sepals, three petals, and six stamens. The petals are mostly white, but each one has several pink lines running half way up from the calyx. The Trillium plant grows in all the New England states and in Canada."

WILL.

"We have just had a short lesson on a very common little butterfly, called the Colias philodice. It is a very beautiful and interesting insect. Like all other butterflies it has four wings, six legs and two antennae. The wings expand about two inches. The general color of the wings is yellow, of the brightest shade. All the wings have a black or very dark border all around them. On the forewings the border is much wider than on the hind wings. Near the middle of each front wing there is a small black spot, and a little place in the center of it is translucent. On the hind wings there is an orange spot, and all around it there is a ring of dark yellow. Along the border of all the wings there are yellow spots in a row near the edge. These butterflies live

only about thirty days, but they seem to be very happy while the sun shines, and they go from flower to flower for the honey." ROSIE.

"The weather has been very changeable ever since sunrise. Early this morning the sun was shining, the air was clear and the sky was blue. There were no clouds except a few cumulus clouds near the zenith, and they were as bright and beautiful as possible as they changed into many curious shapes. Just at school time it grew darker, but cleared up in a little while, and then grew darker once more. At recess time the whole eastern horizon was bright blue, with a few lovely stratus clouds from ten to twenty degrees high. The wind blows gently from the west now, at the rate of a mile an hour, I should say. We used some thistle-down in the garden to see which way and how fast the air was moving. Just before recess we had several nice and very interesting experiments to show us the properties of the air." BESSIE.

THE BUTTERCUP.

"The early buttercup is an interesting plant. It grows only a few inches high. It blossoms very early in the spring, and the flower is bright yellow. The calyx has five parts, and the blossom has five petals. The petals are about half an inch long."

JOHN.

"The Clintonia is a very beautiful plant. It is generally found in damp woods. It grows nearly a foot high. At the top it bears four or five large nodding flowers. The Clintonia grows in the six New England States, and westerly to the Mississippi River." BESSIE.

"The Sanguinaria plant, or Blood Root, is very beautiful. It grows in very rich, damp soil, and blossoms quite early. The sap of the roots and of all other parts of the plant is red and bitter. The leaf has eight lobes, and there are rounded sinuses between them. The flower is white. It has two sepals, eight petals, and about twenty-four stamens."

IDA.

"The Uvularia is a very interesting plant. It grows in damp shady places and is about eight inches high. Near the top it divides into two parts. One part has only leaves — the other part has leaves and one large flower. The flower has six light yellow petals nearly an inch long." SUSIE.

"The Potentilla argentea is a very small plant. It grows in dry, hard ground where most other plants never grow. This little plant has very pretty yellow flowers from June till September. The flower has five sepals, five petals, and many stamens. Each leaf has five leaflets. The under side of the leaf is

much lighter green than the upper side. There are a few small teeth on the margin of the leaflets near the apex." MAY.

"The Aspidium spinulosum is a very beautiful fern. It grows in the woods. It will grow in pastures where there are a few trees to shade it a part of the time. The frond has a graceful lanceolate form, and it is twice pinnate. In good soil this fern grows about fourteen inches high." JANE.

THE WEATHER.

"This is a very pleasant day. The wind is very nearly west. The sun is shining brightly. There are a few stratus clouds near the western horizon, and some cumulus clouds near the zenith. Both these kinds of clouds are fair weather clouds. We can see the beautiful blue sky in many places through the clouds. ELLA.

THE WEATHER.

"At recess this morning the air was very still, and there were no clouds at all. At noon there were stratus clouds just above the horizon, cumulus clouds half way to the zenith, nimbus clouds down low in the east, and high above them over a large space there were cirrus clouds of many shapes, and there was a cold east wind." OLIVE.

"It is very warm today and the sun shines about half the time. The other half of the time the sun is behind a large cumulus cloud.

"Yesterday it was very foggy all day and the sunbeam could not get through the fog. The sun is so far away I should not think the light could go so far even when the air is clear." EDITH.

"We had three very interesting experiments this morning to show that air swells or expands when it is warmed. When we think there is nothing in a dish or a bottle it is always full of air. The apparatus used was a round flask of thin and very clear glass, a bent glass tube in a cork, and a small glass tunnel in a cork. Water was poured into the tunnel, but it would not run through into the flask until a part of the air came out." HENRY.

"The sun rises very early now, and soon we shall have the longest day of the year. Soon after sunrise this morning the dew-drops were very thick on the grass and on all other plants.

"Just as the sun went down last night some of the clouds in the west were brighter than gold. One cloud had four or five shades of red. The lightest shade was pink and the darkest was crimson."

NINA.

GRADE II.

The Littorina Snail.

"It lives in shallow water around every sea north of the equator. The shell is quite pretty. It is nearly an inch long and half as wide. The body whorl is yellow, and is covered with rows of little ridges. The apex is very sharp, and is of a dark yellow color. The aperture is round and one side of it is light green. The inside of the shell is white, and I can see some parallel, raised lines there. The snail is a very slow one, for it can go only four inches a minute. It is an herbivorous snail, for it eats nothing but sea-weeds."

Ima.

The Cypraea Onyx.

"The general color of this shell is brown. The body whorl is light brown, with a spot of white on the back near the middle. On the body whorl near the aperture there is a stripe of dark red. One part of the stripe is light brown. The aperture is quite wide. The outer lip is dark brown, and there are seventeen teeth on it. The teeth are red and the spaces between them are dark brown.

"This shell is found in the shallow water of the

Japan Sea, Yellow Sea, Blue Sea and China Sea; also on the shores of all the Japan Islands."

EDIE.

"The Strombus gigas is a very big shell. My shell weighs three pounds and a quarter, and it is nine inches long and seven inches broad. It has ten whorls and the body whorl is very large. Each whorl has seven or eight spikes, or spines. Each spine on the body whorl is an inch high, and on the next whorl half as much as that, and the next the half of that, and it goes on that way till they get very small. There are seventy-nine or eighty spines on my shell. The aperture is pink, and near the edge of the outer lip it is salmon color, and it is scalloped all the way. Where the spines show inside it is hollowed out, and the hollows are very dark pink. This is the prettiest shell that I have ever studied — it is so large and handsome. These shells were found on the shores of Hayti. They are also found on the shores of Cuba, Jamaica, Porto Rico, all the Bahama and Caribbee islands and all other islands in the Caribbean Sea." IDA.

"When I got up this morning it was very cold indeed, and the window was covered with frost. Although the sun shines very brightly, it does not make the air warm. There is a very strong west

wind, but it does not very often blow any clouds across the sun. Last night the nimbus clouds began to gather in the south and east and it soon began to snow very fast. The flakes were large and very perfect in shape. They were all the same beautiful shape, and had six sides more symmetrical than any one could possibly draw them. The snow in the public garden is a foot deep, and the wind drives it about every way; and the drifts are the highest I ever saw.

"In our science lesson after recess we had an experiment on a mineral called Iceland Spar. It was put in water and the water had no effect upon it, but when muriatic acid, which looks just like water, was poured in, it instantly drew away the atoms of the rock, one from another. I enjoy these lessons and experiments very much indeed." MINA.

"The Tapes literata belongs to the family of Veneridae. It is two inches long and one inch broad. Its color is light brown with dark brown spots. The lines of growth are slightly raised, and parallel to the edge of the shell. The hinge is very small and is not in the middle. This shell is found on the shores of India, Andaman and Nicobar Islands, Ceylon, Maldive and Laccadive Islands. The market place is at Colombo, the capital of Ceylon." ANN.

"Our lesson in shells today was upon the Natica mamilla, a shell from the family of Naticadae, a family which none of us ever has studied before. This shell is a remarkably pretty one, for it is pure white. The body whorl is very large in comparison with the spire. The shell is less than an inch long, and it is shaped like a semi-circle. It is quite thin at the edge, but it becomes quite thick at the middle of the body whorl. This shell may be found on the shores of all the Islands north of South America, in the Caribbean Sea."

THE CYPREAE RETICULATA.

"This is a very pretty shell. It is found on the coast of the Celebes Island, and all other East India islands. The shell is about an inch and a quarter in diameter and nearly four inches in circumference. On the back of the shell there is a very light green stripe running the whole length. In the aperture there are short, brown ridges. The shell is mostly covered with white spots and dark brown stripes." JAMES.

"The Trochus niloticus belongs to the family of Turbinidae. The spire is a perfect cone about three inches long and two and a half inches broad at the base. It has five whorls. It is a very beautiful

shell, for the outside is covered with a pearly enamel, and when it is held in the light it is iridescent in many places.

"This shell is found on the shores of the China Sea, the Yellow Sea, and around the Philippine Islands and the Formosa Islands." LUCY.

SHELLS OF TORRID ZONE.

"The Cassis testiculus resembles in many respects the Cassis vibex. It is somewhat smaller, being only about two inches long, and about an inch and a quarter in thickness. It is of a pink-white color, deeper in some places than others. There are grooved lines running around the shell parallel to the suture, and rows of ribs crossing them at right angles. The outer lip turns back like that of the Cassis vibex, and has brown stripes crossing it at right angles to the edge. The aperture is longer and narrower than that of the Cassis vibex, and there are larger teeth on the inside of the outer lip. The inside of the shell is white. The inner lip is white, and has teeth, which are smaller than those on the outer lip. At the base of the aperture there is a deep canal. The spire is of a lighter color than the body whorl. The apex is sharp, and is white. The suture is not deep. This shell is found on the shores of Ceylon, the Lacadive and Maldive Islands, Sumatra, Borneo, and New Guinea." BESSIE.

THE WEATHER.

"This is a warm sunny day. This morning there were large nimbus clouds all along the southwestern horizon, and I felt sure it would rain; but after a few hours the whole sky was quite clear, and the color of the sky was a very pretty shade of blue.

"Yesterday morning I could see no clouds but some long stratus clouds in the west, and a few cumulus clouds up very high. As both of these are fair weather clouds, I was sure it would be fair all day; but a little before the middle of the afternoon it rained hard, and there was a strong wind.

"One of our problems today was to find the weight of calcium, carbon, and oxygen in a pound of calcite." JOHN.

THE WEATHER.

"It is not a very fine day, and the sky looks as if we should have rain. This morning it was snowing when I came to school. The flakes were small and were driven about and broken by the wind. The nimbus clouds were heavy and dark, but I could not see them very well because the sky was dark, too.

"I saw a few snow crystals that were not broken. They had six sides and six points. Every part was made very beautiful by other little crystals all over the larger parts. Water is a mineral. Like all other

minerals it has its own forms. The dew and rain drops are globes, because all the atoms are drawn toward the centre. . . .

"This is a pleasant day, though the wind is from the north and it is quite cold. There are a few stratus clouds in the west, and several large cumulus clouds high up in the sky. The blue sky is almost hidden except along the horizon between the long stratus clouds. The ground is covered with snow and ice. The temperature this morning was eight above zero.

"We had very interesting experiments this morning to show how much the air expands when it is warmed. A flask that holds one cubic inch was warmed, and we saw the bubbles of air as it was forced through a long glass tube into another flask."

JOHN.

"This morning it was very cloudy and misty and dull, and I thought it would rain, but when I came to school it was so cold that I thought it would snow, and a little before recess it began to snow lightly but now it is snowing hard and fast.

"After recess we had a very nice experiment which surprised us all. A very little of a bright red powder was put into a small test tube, and the tube was heated two or three minutes. The powder had been separated into oxygen, which filled the tube, and

mercury which we could see inside of the tube in little globes at the top of the tube." SUSIE.

"The wind is blowing quite hard today, and it is very cold. The sky is all covered with thick, dark and gray nimbus clouds, and although it was very pleasant this morning and the sun was shining very brightly, now it is dark and looks as if it would rain very soon.

"We had experiments after recess to show that shells are composed of oxygen, calcium and carbon, the same as all marble and limestone. Forty-eight per cent. of a shell is oxygen, 40 per cent. is calcium, and 12 per cent. is carbon.

"In our arithmetic lesson we found the weight of each element in several shells which were weighed before us for our problems in arithmetic."

CORA.

"This is a warm and sunny day. The sky is blue, and half covered with large white cumulus clouds. We have had a lesson upon a very beautiful mineral called calcite. It looks like ice, but not so clear, but it is translucent. The sides of a crystal are either square or oblong. The sides have two obtuse angles, and two acute angles. A crystal of calcite is a rhombohedron, for a cube has all right angles.

"Calcium is a rare metal. It is yellow, and it

costs ten times as much as gold. Carbon is a black element generally, but a diamond is crystalized carbon, and it is the hardest of all minerals." DAVID.

"At recess the wind was easterly and the sky was mostly covered with dark nimbus clouds. The wind blows at the rate of about seven miles an hour. I think it will snow before night.

"This morning we had several experiments on the most abundant of all the elements. Its name is oxygen. A coarse white powder like salt was put into a flask and heated in the flame of alcohol. The oxygen was separated from the powder and forced through a tube into some glass jars. Then a piece of iron wire was put into the jar and it burned, making a very bright flame, and sparks went out every way." JOIE.

"It is very pleasant today, and is much warmer than it has been for some time except yesterday, when the ice was melting and dropping from the houses. Today, though the sun is shining, the ice is hard and smooth. Yesterday the sky was covered with very interesting cumulus and stratus clouds. They all had a reddish tinge, but were ornamented with many other colors and shades, and a great variety of shapes which were changing all the time.

We are never tired of studying the sky, because it is always beautiful and always changing. The sky now is of a very pretty blue with soft white clouds in some parts of it. They do not seem very far up in the sky." SARAH.

THE BLACK CHERRY TREE.

"There are forty kinds of cherry trees in the world, and ten of them grow in the United States. The wild black cherry is one of our best timber trees. The wood is light and pretty. It has a great deal of silver grain, and the rays are long, fine, and close together. The color of the sap-wood is white. The heart-wood is light red, with darker stripes running through it. The wood is used for bureaus, tables, school desks, window sashes, posts for stair rails, and many other things. The bark is gray outside, but the inner bark is light yellow next to the wood, and darker near the outer bark. The leaf is ovate and comes to a point at the apex. It is finely net-veined, and the margin is very finely serrate.

"This tree grows in all parts of North America between the Gulf of Mexico and Slave Lake, Hudson Bay and Hudson Strait. But it grows best half way between Hudson Bay and Gulf of Mexico. There, all through the basins of the Missouri, Mississippi, and Ohio rivers, it grows a hundred feet high and five feet in diameter." GEORGE.

"For study in science today we have Pyrite, which means fire-stone. One of our specimens is massive, and the other is in small crystals. Each crystal is a perfect cube. A cube has six equal sides, eight corners and twelve edges. Pyrite is harder and heavier than any other mineral that we have studied. When broken it has a rough surface and a bright yellow color. When I turn it in the light it glitters like gold, but there is no gold in it at all, for it is 47 per cent. iron, and 53 per cent. sulphur. One of our problems to-day was to find the amount of iron and sulphur in a pound of pyrite. We all found it to be 3290 grains of iron and 3710 grains of sulphur. For the proof we add these, and it makes a pound or 7000 grains.

"Our pyrite came from Ceylon. It is also found on the islands of Sicily, Sardinia, Cyprus, Corsica, Candia, Ceram, Gilolo, Borneo, Java, Sumatra and New Guinea." ANNA.

PLANTS.

"The Iris versicolor, or common blue flag, is a very beautiful plant.

"It grows from two feet to three feet high, but it is never found growing on dry land. It grows best in very damp ground where the soil is rich and dark colored.

"It is an endogen plant; that means that it keeps growing up out of the middle like corn and wheat and all kinds of grass.

"The stalk is always crooked, and it is not quite round, but it is oval shape. Some of the leaves are nearly a foot long, and they are parallel veined.

"The flower is very large, and is purple in color. The flower has three sepals, three petals, three stamens, and three pistils." EDITH.

BUTTERCUPS.

"The Ranunculus bulbosus is a very beautiful little plant. It grows about ten inches high, and is generally found on dry, rocky hills.

"The root looks like a turnip, and there are fine fibres growing out of it.

"There are many fine white hairs growing on the stalk. The flower is bright yellow. It has five sepals, five petals and nearly forty stamens. There are a great many pistils and they are green. The stamens are yellow. The petals are half an inch long, and there are parallel lines running lengthwise on both sides. This plant is one kind of buttercup, or crowfoot. NINA.

THE HILLS AND VALLEYS

"Today the air is soft and warm, and there are no clouds in the sky. Yesterday we went into the woods

on a high hill. The hill is covered with large trees of many kinds. We found sugar maple, beech, oak, poplar, white ash, and many other trees and shrubs. I think the white ash trees are the prettiest of all, they are so tall and straight. The leaves have come out on the sugar maple trees, and the buds are opening on some other trees.

"The wild red cherry tree grows only about twenty feet high and its trunk is from three to six inches in diameter. It is very common in all the river basins in Maine, New Hampshire and Vermont. It blossoms in May and is then a very showy tree. In the last part of summer it is made beautiful again by its bright red fruit. The leaves of the red cherry are about three inches long and about half as wide. They have a serrate margin and a sharp apex, and both sides are bright green." EURA.

THE ASPIDIUM NOVABORACENSE.

"The Aspidium Novaboracense, or New York shield fern, as it is sometimes called, is found chiefly in New York state, but it is found as far south as the James River, west to Ohio and Lake Huron, and north to the Gulf of St. Lawrence. It is found growing in both sun and shade, though it prefers a damp, shady spot. It grows generally about one foot and a

half high and nearly three inches wide in the broadest part — the middle.

"The stipe is about four inches long and is grooved on its upper side.

"The pinnae are sometimes nearly two inches long and half an inch wide. There are twenty-two pairs of pinnae on the rachis — some are opposite, but most are alternate. The pinnae are divided into pinnulae or lobes; there are about forty-four pinnulae on the second rachis and they are all opposite." ISA.

GRADE III.

The Hemlock Tree.

"The Hemlock is one of the best of our forest trees. It is a graceful and very useful tree. It makes the best timber for the frame of a barn or a house. The bark is used for tanning leather. The wood is good to burn in a tight stove, and to heat an oven.

"This tree grows best at about forty-five degrees north latitude, where it is found ninety feet high and three feet in diameter. It grows as far north as sixty degrees, but it does not grow nearly so large there.

"The wood is white, and between the yearly rings it is yellow. It comes apart easily between the rings because there are no strong rays to hold it together. In the best places it grows a quarter of an inch thick all round the tree in one year. Where the tree does not have a good chance it grows so slow that we can scarcely count the rings, because they are so thin.

"The bark on old trees is an inch thick, and there is a new layer every year next to the wood. The outer bark is gray, or dark brown. The inner layer is white with a yellow tint. Between these two layers there is a crimson layer and a light brown layer.

All through the bark each color shades off into the next color.

"The hemlock tree has the smallest leaf I ever saw on any tree. It is only a third of an inch long, and the sixteenth of an inch wide. So it takes 48 leaves to cover a square inch. They grow alternately all around the stem. The shape is linear and it has a round base and apex. The leaf is flat and straight. The upper side is dark green and glossy. The under side has several white lines with parallel green stripes between them. Although the tree is an evergreen, the leaves stay on only about three years, and new leaves come on every year as the twigs grow out longer.

"The seeds are brown on one side and gray on the other. The length is the sixteenth of an inch, and half as wide. Each seed has a yellow wing about the shape of that of a house fly, and the same size. The cone is an inch long and half as wide. There are about thirty scales on one cone, and two seeds to a scale.". JOHN.

THE SUN.

"About two and a half years ago, the first day we ever went to school, we learned some very interesting things about the sun. The sun has lighted up the sky and landscape beautifully every day since, and it

is almost a thousand days, for in two years there are 730 days, and in half a year, over a hundred and eighty.

"The girls and boys in our class are now learning more about the sun by setting stakes in the ground and sighting over them, to see how much it changes its place to rise and set each day. We have found that soon after we have the shortest days the sun rises earlier and farther north every day, and sets later and farther north every day. None of us understands just how this is brought about. It cannot be the daily motion of the earth on its axis, so it must be its yearly motion round the sun that causes it in some way." IDA.

THE SPONGE.

"We are now studying the lowest branches of the animal kingdom — the Radiates and Protozoans. Every one is familiar with the looks of a sponge, and most people who go to the beach have seen the Sea-Urchin and Sea-Anemone.

"The sponge, as we see it every day, is the skeleton of an animal. The flesh of the animal looks like jelly: When the sponge is alive, the jelly covers every part of the skeleton just as the bones are covered in other animals. The sponge is the largest of all the Protozoa, and there are many species of them, most of which are so small we cannot see them.

While the sponge is alive it is always attached to a rock. On the top of the sponge are two large holes which have smaller ones branching into them. The sponge is the most ignorant of all animals. It cannot see, hear, taste, smell nor feel, and it seems to know nothing at all. It has no blood, and only water circulates through the tubes. It lives on little animals that flow into it through the small tubes with the water.

"The Sea-Anemone belongs to a class a little higher than the sponge. It has feelers all around its mouth, and they look like fine sea-weed. The feelers can contract and expand when they like, but their movements are very slow. There are many species of these animals, and some of them come from eggs, and others from buds that grow out as they do on a tree."

HENRY.

FERNS.

"The Aspidium thelypteris is a very pretty fern and it grows in damp places, generally on the banks of brooks or rivers in the eastern United States. They do not grow in groups but one alone in a large patch of them. It is usually from one to two feet high and about five inches wide.

"The stipe is about five inches long and is slender. It is covered with fine hairs and on the under side is

grooved. The frond is generally about twelve inches long.

"The pinnae are remarkable for being nearly the same length, until near the apex. They are about two inches long and there are usually about nineteen pinnae on each side of the rachis. The pinnae are divided into lobes which are cut down nearly to the mid-vein. The veins are very fine and are all forked. The sori are very small — of a dark brown color, and there are from five to ten on each lobe.

"Most ferns do not have a common name but this is called the lady-fern." NINA.

A GENTLE SHOWER.

"We were glad yesterday afternoon to have a gentle shower without lightning and thunder. The rainfall was nearly half an inch. It made the ground moist and nice for the roots of trees and grass and all other plants.

"Every plant has a great many roots so small that we can hardly see them. The fine roots draw the water from the soil and it goes to every part of the plant and makes it grow." JANE.

NIMBUS CLOUDS.

"The sun is not shining at all this morning. Nimbus clouds cover more than three-quarters of the sky. The air is not clear and I think it will rain be-

fore many hours. Nimbus clouds are rain clouds and they are down lower than the other kinds. Sometimes there are fair weather clouds over the nimbus clouds and much higher up. Through an open place in the sky I saw a small cumulous cloud up very high above the storm cloud." MARY.

"This is a bright beautiful morning. There are cumulous clouds up about forty degrees high, and stratus clouds twenty or thirty degrees above the horizon. Both are fair weather clouds and it will not storm until we have some nimbus clouds.

"We had some interesting experiments at ten o'clock to show that there is carbon in sugar. Carbon is the same as charcoal, and we saw it taken out of the sugar." IDA.

THE CASSIS RUFA.

"The Cassis rufa is a very handsome shell. It is very large indeed. It has the aperture on the face, like all the Cypraea shells that we have studied. The aperture is very large. It is a little more than three inches long, and the teeth are in the inside of the aperture farther than in Cypraea shells. The back of the shell is covered with nodules of a grayish brown color, while the shell is red and white or orange and white. The very top is more of an orange

color. There are seven whorls to my shell, and they reach to the apex which is very small indeed. The outer lip is turned up and it has dark brown lines on it. The lines are very broad and they grow darker towards the apex. The canal turns back and there is a deep cavity just behind it." LOU.

"The Cypraea arenosa is an interesting shell though not so pretty as some. It is nearly two inches long and over an inch thick. In color, on the back, it is of a light reddish yellow, with five lines of deeper red running across it. These lines are about a tenth of an inch wide; but they do not show very much at a distance, for the color is not a sufficient contrast with the rest of the shell. Around the edge of the shell there is a raised line about a quarter of an inch wide, and it seems to be pure enamel. Its color differs enough from the rest of the shell to make a good contrast; for it is a very pretty fawn color, and it has some small white dots over it." IMA.

"The Harpa minor is a beautiful shell. It is about an inch long and three-quarters of an inch wide. This shell has five whorls and the body whorl is larger than all the others.

"The outside of the shell is rough, and it has many colors. There are different shades of red, blue,

yellow, and light and dark brown. There are twelve large ribs, and each one has a great number of lines crossing it. Some of the lines go across straight, and in some places the lines slant and look like little waves.

"The inside of the shell is very smooth and white with a few dark brown spots. There are twelve kinds of Harpa shells, and this is, or was when it was found, the smallest known Harpa. Harpa minor means smallest harp, for the ribs make the shell look like a harp. These shells come from the water around the Philippine Islands." JOIE.

"We have been learning some very interesting things to-day about the mineral kingdom. The natural shape of water and mercury at common temperatures is a perfect globe. But in very cold weather water freezes, or crystallizes, as we have seen it on the window panes, and in snowflakes.

"All the minerals that form the crust of the earth have a natural shape of some kind called a crystal. We saw several very pretty ones to-day, and we made a drawing of a quartz crystal, which is a six-sided prism with a six-sided pyramid at the end."

BESS.

THE WHITE ASH.

"The Fraxinus Americana or common White Ash

is a very fine tree. It grows well in all parts of North America between forty and fifty degrees north latitude. It grows well in Canada and all around Lake Superior and all the other great lakes. In the western part of Massachusetts it sometimes grows more than a hundred feet tall, with a trunk more than four feet in diameter, and sixty or seventy feet high without a branch.

"The wood is white, very tough, and very elastic and strong. It is used for wheels and all other parts of wagons. It is good to burn, and it is put to more other uses in this country than any other tree. It is used for the handles of rakes, pitchforks, hoes, shovels, and many other tools."

Feldspar.

"This morning the air was clear, the sky was deep blue, and there was not a cloud to be seen, but before noon the sky was completely covered with two or three kinds of clouds, and it soon began to rain. Yesterday afternoon at recess time there was a long cirrus cloud which stretched entirely across the heavens from horizon to horizon.

"Our science study to-day was on a mineral called feldspar. Next after quartz, it is the most abundant of all minerals, and it is found in every country in the world. Feldspar is made up of four elements,

which are oxygen, the most abundant of all the seventy elements, silicon, the next most abundant after oxygen. These two elements make up three-quarters of the weight of feldspar, and two remarkable metals make up the other quarter.

"Another way of stating this, as we do when we work problems in arithmetic about this mineral, after we see our specimens weighed, is this: In one hundred grains of pure feldspar there are 46 grains of oxygen, 30 grains of silicon, 14 grains of potassium, and 10 grains of aluminum. Then in one pound, or seventy hundred grains, there are seventy times these numbers, and the oxygen is 3220 grains, silicon 2100 grains, potassium 980 grains, and aluminum 700 grains. All these parts added make the whole, or 7000 grains.

"When feldspar is broken the break follows the cleavage planes which run through it in two directions which are at right angles to each other. These planes have a bright pearly luster. Feldspar is not quite as hard as quartz. Its degree of hardness is six, and quartz is seven, and the diamond is ten, which is the hardest thing in the world. Talc is the softest of all minerals. Its degree is one in a scale from one to ten. Feldspar is slowly ground by natural processes, and converted into clay, which is made into pottery, and the finest of it into porcelain, another name for

which is china. Feldspar helps very much to make the soil fertile, and by holding the moisture it keeps the soil from drying up in a dry summer.

"We have had at least a dozen very brilliant experiments with the four elements which make up all feldspar. Potassium was thrown into water and it instantly set the hydrogen in the water on fire, while the oxygen set the potassium on fire, and both burned together."

Wheat.

"For nature study this morning we have the mature wheat plant. My specimen is forty inches high. Its color is a beautiful shade of light yellow — the real straw color. The nodes, or joints, begin just above the roots, and are all just about twice the distance from the next; for instance, the first is one inch from the root, the second two inches from that, the next about four inches from the second, and so on all the way up. The nodes are perfectly solid, while the rest of the stock is hollow, and at every node a long, narrow, parallel-veined leaf grows out. The nodes are of a little darker color than the spaces in between, which are called internodes. The internodes are largest in the middle, and taper all the way from the middle to the nodes.

"The spike or head of the wheat is about three

inches long, and is of the same color as the stalk, and there are spikelets growing out alternately on the rachis all the way up. The rachis is the stem that runs through the spike, and it is all zigzagged, first curving to one side and then to the other, with a little notch at each bend.

"The spikelets are made of many parts. First on the right and left, is a little boat-shaped husk, called the glumes. The glumes are about one-third of an inch long. Then come some more little husks of nearly the same shape, called paleae. The seed, or kernel of wheat grows in the cavity between the two paleae, and is completely covered by them. The kernel is of a brown color and it has a groove running the whole length. There are many varieties of wheat, and the kernels of different varieties vary in size and hardness, and the color of the flour.

"Wheat is one of the most valuable of all plants. The seeds are made up of twelve elements so combined into several compounds as to make the best of food. Wheat will grow in nearly all parts of the world except the frigid zones. But it does not grow well in the torrid zone, except high on the mountains where the climate is cool. A belt of land a thousand miles wide, extending across America, Europe and Asia, with its southern boundary half way between the

equator and north pole, contains nearly all the best land for wheat in the world.

"The best wheat area in America begins at the Rocky mountains, extends due east a thousand miles to the great lakes, Michigan and Superior. Another wheat area equally good begins at the Ural mountains and Ural River, which form the boundary between Europe and Asia, extends west one thousand miles to the Carpathian mountains and the Baltic Sea. It extends from St. Petersburg, the capital of Russia, one thousand miles to the Caspian and Black Seas. This area is drained by three large rivers — the Volga, Don and Dneiper. This great field is all in Russia, and the great Russian wheat and flour markets are Warsaw, Moscow, and St. Petersburg.

"The English markets for Russian wheat are Dover, London, and Liverpool. The French markets are Havre and Paris. In Germany, Hamburg on the Elbe, and Berlin, the capital, are great markets for wheat."

ELLA.

GRADE IV.

The Acer Pennsylvanicum.

"This beautiful little tree has two common names, viz. striped maple, and moose-wood. It grows in the basin of the Mississippi River all the way between the fortieth and fiftieth degree of north latitude.

"On the Appalachian Mountains it grows south as far as Georgia, and north to Canada.

"The striped maple generally grows only ten or twelve feet high, but where the soil and climate are just right it grows thirty-six feet high and seven inches in diameter at the base. The use of the moose-wood is for inlaying work and other ornaments, and also for the food for moose. They eat the bark and twigs for the sweet sap in them. When they take too much of the bark off it kills the tree.

"The wood is very heavy and white. The heart wood shows the silver grain better than the sap wood. On the end where it is cut off, the rays are very fine, close together, and very straight. The fibers of the wood are not easily separated.

"The bark of the striped maple is thick and fibrous. When dried, it is light reddish brown next to the wood, and black, striped with dark brown and

green outside, with little raised places all over it. On the branches the bark is light and dark green, red, white and yellow, with a great number of small rings, and some large rings where branches had been.

"The leaf of this tree is about six inches long and four inches wide. In summer the leaf has a light, delicate green color, and in autumn it turns to a delicate yellow with red spots. The tree has a great many leaves, and they are large for a small tree. They grow opposite, never more than two in a place, and where there was a pair of leaves last year there is a branch this year, and leaves are growing on it. All the leaves have either three, five or seven veins close to the stem, and many veinlets grow in all directions from these, making a net-veined leaf. The margin of the leaf is doubly serrate, and the apex is very sharp. The lobes are sharp and the sinuses are rounded at the base.

"The seeds grow in large clusters of forty or more. The clusters hang downward twined in among the leaves. In the spring the tree has a flower to every seed. When the blossom falls off the seed begins to form, and it is the same color as the leaf, and in autumn it turns yellow and falls off. The seed is in the shape of a half ball, and is an eighth of an inch in diameter. It has a wing an inch long and quarter of an inch wide, and it is net-veined. After the out-

side shell is taken off, a brown seed can be seen, and if the outside of this is taken off, the whole tree can be seen. There are two leaves, and between them the trunk with the root on the end. All parts of the little young tree are a light yellowish green color."

DAVID.

DEWDROPS.

"This morning there was a very heavy dew, and I could see thousands of rounded dewdrops on the grass. It was a beautiful sight, for the dew sparkled in the light and I could see nearly all the colors of the rainbow. The dew comes from the air. There is always water in the air, and the whole atmosphere always contains water enough to cover the earth several inches deep. When the air is made cold enough the water in it is formed into perfect little globes or drops which are perfectly round like the little globes of mercury we saw some time ago in the experiments in chemistry. When the drops of water are formed in a cloud and fall to the ground we say it rains; when the drops are so small we cannot see them they form the dew on the grass and trees. In warm weather when we have a pitcher of water with ice in it the dew collects on the pitcher, but we do not see the little globes fall." HELEN.

The Rock Maple.

"The Acer saccharinum, or Rock maple, is a very beautiful tree, especially in autumn. There are forty species of maple in the world, and five of them grow in Massachusetts. The largest rock maples grow a hundred feet tall and six feet in diameter at the base. It is one of our best shade trees and it reaches its greatest size and perfection in Vermont and New Hampshire. The wood is white and very solid and hard. It makes the very best wood to burn, and it is highly prized for all kinds of nice furniture on account of its beautiful silver-grain.

"The leaf of this tree is four or five inches long, and it has many sharp points. In color it is bright green and very glossy. The leaf is net-veined and the veins are yellow. The stem is about an inch and a half long, and there are several small grooves running the whole length. The pith rays are very fine and lighter in color than the rest of the wood. The annual rings are quite thick, and the inner part of them is light brown. The ducts, if any, are so fine that they can hardly be seen.

"The seeds are round and grow together, separated only by the stem. They have wings of a light buff color, and the wings have many fine veins. The sap of the rock maple tree contains sugar, and if twenty pounds of the sap is boiled away, there will be about

a pound of sugar. The trees are tapped for the sap about the first of March."

Radiates.

"Our science work for to-day is the study of the Starfish and Coral Polyp. Both of these belong to a very low class of animals, called Radiates.

"There are hundreds of species of Polyps, and they all live in the ocean, and most of them in or near the Torrid Zone. They differ very much in size, shape and color. Some are microscopic, and some are six inches, or even a foot in diameter. The Polyp is a tube with a round disc and mouth at the top, with a row of feelers around it. The feelers draw in particles of dirt, or animal and vegetable substances which are the food of the Polyp. These animals never move from their place, and when they die the skeleton remains and helps to make the coral. Coral is of many colors and forms, and many kinds are very beautiful. Polyps have done some good, for they built up the Maldive and Lacadive Islands of coral, which is becoming limestone and marble."

The Osmunda Cinnamomea.

"This is one of the most beautiful ferns we have studied, and it is as interesting as it is pretty. It is found in all the states east of the Mississippi River,

also in Mexico and Central America, and in Colombia, Venezuela and Brazil. Also in Asia, the Bahama Islands, Hayti and Cuba. It grows from two feet to five, and is generally found in shady, low places. Its common name is Cinnamon Fern, from the color of the wool.

"The stipe is from six inches to two feet long, and is a light green color. Near the base it is covered with dark brown spots, and it has two or three deep grooves running the whole length. The frond is from one to three feet in length, and from half a foot to a foot in width. It is a light green color.

"The pinnae are from two to six inches long and nearly an inch wide. There are about thirty-six on the rachis and they are all opposite except near the apex. They are divided into lobes which are cut down nearly to the mid-vein. They are covered with very fine hairs, and where they join the rachis there is some wool. The wool is found along the stipe, and is a bright cinnamon color, from which the fern takes its name." EDNA.

THE MITRA EPISCOPALIS.

"We have just finished a very interesting lesson on the mitre shell. It belongs to the family of Volutidae. This shell is about three and a half inches long and three-quarters of an inch thick. It looks

like a bishop's cap, and that is what its name means. The general color of the shell is white, but there are large bright red and yellow spots all over it.

"There are two rows of spots nearly a fourth of an inch square. Just above these there is a row of smaller spots, and again above that there is a row of much larger spots which are all different shapes. Then, on the next whorl, there is a row of the small spots, and above that there is a row of five-sided spots. Below the row that I first described there is one rather large line of spots, and below that the lines are so near together that they run into each other. The last two whorls look as if they were made of glass.

"This shell has very fine lines running parallel to the suture, which run just as the spots do from whorl to whorl. This shell is very thick and heavy. It weighs 1468 grains. Like all other shells, it is composed of oxygen 48 per cent., calcium 40 per cent., and carbon 12 per cent. It is found on the shores of Ceylon, in shallow water not more than a hundred feet deep."

ELLEN.

BOTANY.

"We are studying a very interesting little plant this morning which belongs to the Rose Family. This is a very large and important family of useful

plants. It contains nearly a hundred genera and more than a thousand species. It includes all kinds of roses both wild and cultivated, — all pear, cherry, and apple trees, — all raspberries, blackberries, and strawberries, — all peaches, plums, and apricots.

"The Spiraea tomentosa, or hardhack, is the species we have for study. This little shrub grows about two or three feet high. The stem is quarter of an inch thick near the ground and only half as large in the upper part. The branches and leaves are alternate. The leaf is ovate and has a serrate margin and a sharp apex. It is dark green on the upper side and very woolly on the under side. The flowers grow in a large cluster at the top. The cluster of flowers is an inch thick, but it tapers very symmetrically all the way up and comes to a sharp point. This plant is sometimes called steeple bush, because the cluster of flowers resembles a church steeple, and I think its form is a perfect model for a church tower."

EDITH.

THE CONUS MARMOREUS.

"The Conus marmoreous is a very beautiful shell. It is found most abundantly near the Equator, on the shores of Borneo, Sumatra, Celebes, Gilola, Singapore, and Amboyna. It is found as far north as the Mediterranean and Marmora seas, and as far south as

the Cape of Good Hope. It is never found in fresh water, but the best place for it is in salt water about from two hundred feet deep to the shore. There are three hundred and seventy-one different kinds of Cone shells living, and eighty-four kinds fossil.

"The shell is about three inches in length, and one and a half in diameter. It is covered with angular white spots on a very dark brown background. The spots are edged with a light orange color. The spire is very short and the apex is very blunt. The aperture is long and narrow, extending the whole length of the body whorl. The inside of it is white and a delicate pink. The suture has little teeth about one-eighth of an inch apart, and the same in height. These teeth are white. The surface of the shell is very smooth, and it is quite thick and heavy. The body whorl is about four times as large as all the other whorls taken together, and the base is grooved. There is a little notch at the end of the aperture, near the suture.

"The mollusk lives on the flesh of other mollusks and occasionally on seaweed. It likes a warm climate and hollow rocks with a very little water. It travels very slowly." ELLA.

THE WIND.

"The air is very still this morning. I could not

find out which way the wind was till I began to watch the smoke coming out of the chimneys. There were clouds just above the horizon in every direction, but I could not see them move at all. About a quarter of a mile south of me there was a very tall chimney, and the dark gray smoke went up exactly straight about sixty or seventy feet, I should say, and then it went almost horizontally towards the east. Of course I concluded that the wind was west. Soon I began to look for other chimneys, and I found that the smoke was going in a slanting way to the west from all short ones, while it went in the opposite way from the highest ones. My experience this morning reminded me that one day last week I saw clouds high up near the zenith moving in three different directions. One cloud went south, another northeast, and another west. This last went very fast and I found that it was not up nearly as high as the others."

EMMA.

THE APPLE TREE.

"This tree belongs to a large class of very important and useful plants called the Rose Family. The family contains nearly a hundred genera and a thousand species of plants. These plants furnish by far the greater part of our most delicious fruits, some of which are the peach, quince, apricot, pear, plum,

cherry, strawberry, raspberry, and blackberry. The family also ornaments our orchards and gardens with the most beautiful and fragrant blossoms from early spring till the end of summer. It includes all the wild roses, such as the sweet brier and the Rosa Carolina, all cultivated roses, the flowering raspberry, the spiraeas, and many other plants.

"The largest trees in this family are the pear, apple, cherry, the wild sugar pear, and the mountain ash. The apple tree does not grow tall, but spreads out very broad. The trunk is thick and short. The branches are long, and they grow out horizontally from the trunk. The tree is very easy to climb, and it makes a beautiful sight when it is in full bloom, and again when the apples are ripening.

"The blossom is a beautiful color of light pink and white. Just under the five petals there are five green sepals, and five small bracts under them. The flower has twenty stamens and all its parts but the calyx drop off in a few days, but the sepals always remain, and may be seen on the end of the apple opposite the stem. In the apple there are five carpels, or seed-boxes, and two seeds in each." EDITH.

SAMPLES OF WORK DONE IN THE GRAMMAR SCHOOL GRADES

GRADE V.

The Hemlock Tree.

"The Abies Canadensis, or common hemlock spruce, is a very beautiful evergreen tree. It grows best at about forty-five degrees north latitude, growing there about eighty feet in height and two and one-half feet in diameter. It is found as far north as fifty-one degrees and as far south as forty-one. It is the most graceful tree of the cone bearing family, and lives to be three hundred years old. It grows as far west as the Pacific Ocean, but not very plentifully. It is not found in the Old World at all.

"The bark is very rough and in some places it is of a bright crimson color. The inner bark is of a dark brown color and is very fibrous. On an old tree the bark is very rough, but on the branches and twigs it is always smooth. On an old tree the bark is sometimes an inch thick.

"The wood is not very heavy, and is fibrous. The heart-wood is a very little darker than the sap-wood. The wood splits very easily, because the rays are so

fine that they cannot hold the fibers together very strongly. There are no ducts. The wood is used mostly for timbers for barns, and sometimes for fuel. It is not very often used for fuel, for it snaps a great deal.

"The leaf of the hemlock spruce is something like that of the pine. It is linear, and is about one-third of an inch in length. There are a great many differences between the leaves of the hemlock and pine. The pine leaves grow in clusters, while the hemlock leaves grow singly. The pine leaves are four-cornered, while the hemlock leaves are flat. They are both alike in remaining green all winter. The hemlock leaves grow on a small stock, or stem, and very thickly together. They sprout out of a tiny bulb, and there are three sets of them. One row grows pointing upward, and on each side there is a row pointing outward. The leaves are a very bright green color, and glossy on the upper side, but on the under side they are a light green with tiny white lines. The under side is also glossy. The margin is entire and has tiny white hairs.

"The cone of the hemlock spruce is about three-quarters of an inch long, and half an inch thick. It consists of many very small scales, which are of a dark brown color. The seeds are about one-fifth of an inch long, including the wing, which is of a light

brown color and very thin and delicate. The seed-vessel is oval-shaped, and of about the same color as the wing."

The Birches.

"The birches are very beautiful trees, growing in cold climates. They grow very tall toward the north, but toward the south they are smaller. The best place for them is about sixty-five degrees north latitude. There are twenty kinds of birch in the world, and six in Massachusetts. They do not grow much farther south than the New England states, or farther west than Wisconsin. There is one kind that grows on the island of Terra del Fuego. The tallest birches grow about one hundred feet high."

The Betula Papyracea.

"The Betula papyracea, or paper birch, is a very graceful tree. The wood is nearly white and is made up of small fibers. The pith-rays are very fine, but some of them are quite long. The annual rings are rather broad and far apart, so that we can easily tell the age of the tree. The wood is used for a variety of things, such as bureaus, table-legs, hat-blocks, and will burn very nicely. When it is split, the ducts can be seen quite plainly on the end. The bark is pure white, or nearly so, and is very thin. It

will split into pieces as fine as the thinnest tissue paper. It has also little lines about half an inch long and one-eighth of an inch thick and perfectly straight. They are not in a straight line, but are irregular. The leaf is ovate, or egg-shaped, and varies from two to about four or five inches in length. The margin is doubly-serrate and the apex is very pointed. The base is rounded and for about half an inch each side of the stem there are no notches. The mid-vein is very large and also the veinlets, but the veinlets can hardly be seen. The leaf is net-veined, and on the upper side it is much darker than on the under side. The veins can be seen much more plainly on the under side than on the upper. The leaves turn yellow in the autumn, and grow lighter and lighter until they drop off. The stem, or petiole, is about half an inch long, and is quite thick. The seeds are contained in a tassel-like cone, and there are hundreds of them in a single cone. The cone is called a strobile. The strobiles vary in shape on the different kinds of birch, some being larger on one kind than those of another. The seeds are of two different shapes, one kind being very similar to the leaf of a cactus, being covered with very, very fine hairs, that we cannot see without a microscope. The other kind is in somewhat the shape of a butterfly, having a body, two wings, and

something like antennae. The strobile is the name of the whole cluster of seeds, which combined make a cone-like appearance. It is about one inch or more in length, and is of a light reddish-brown color in the autumn."

The Aspidium Marginale.

"We have had a lesson today upon a very interesting and beautiful fern, the name of which is the Aspidium marginale. It grows about fifteen inches in height, and bends very gracefully. It resembles the tree fern, that grew thousands of years ago, more nearly than any other fern growing in the United States.

"The stipe is about five inches in height, and is of a pale yellow color shading into brown near the base. There is a deep, broad line on the upper side, besides smaller ones. There are a great many dark brown dots on the under side. The stipe is flat and rough, and is much wider at the base than at the part nearest the frond. There is a good deal of chaff on each side of the stipe near the frond, and it is of a light brown color.

"The root is about a foot in length, and resembles the roots of a great many other ferns. It is covered with small rootlets which are really the stipes which grew a great many years ago.

"The frond is a little more than twice the length of the stipe. The upper side is of a bright, dark green color, but on the under side it is much lighter colored and very smooth and shiny. The rachis is not winged, but has chaff growing out on each side, which when pulled out leaves a little dot, like those on the under side of the stipe. There is also a broad line near the center of the rachis, as on the stipe. The pinnae are alternate, and grow nearer together near the apex than near the base. There are twenty-four on one side of the rachis and twenty-three on the other. Those pinnae near the middle of the frond are about three inches in length and one-half an inch in breadth, while the two lower pinnae are only about two inches long, and the upper ones are so small it is difficult to count them. The pinnules are alternate, and have an entire margin. They are about a third of an inch long and one-fourth of an inch broad. They are as broad at the base as they are at the apex, the latter being round and broad. The veins are of a dark brownish-green color, and the apex of the pinnae curves upward.

"The Aspidium marginale takes its first name from the sori, which is covered with a little napkin that is in the shape of a shield, Aspidium in Greek meaning a little shield, and its last name, marginale, from

the sori growing very near the margin of the pinnae. The veinlets are forking.

"The Aspidium marginale grows on rich hillsides, and between rocks in rich soil. It is found in all the states east of the Mississippi river, excepting Florida. It also grows in Canada as far north as fifty-two degrees north latitude, and as far west as Lake Winnipeg."

Titanium Ore.

"This is a very sunny, beautiful day, warm, and very clear air. The wind blows very gently toward the east at the rate of about three or four miles an hour. The sky is of a bright shade of blue, and is partly covered with stratus and cumulus clouds. We had a very pleasant recess out today, and when we returned we had our second lesson on minerals this year. The subject was Titanium ore.

"This is a very pretty mineral when broken, but on the outside it is rather common and plain looking, as the colors are dull. When it breaks it has sharp angular corners and sparkles a great deal when held in the light. In one hundred grains of Titanium ore there are sixty-one grains of Titanium, and thirty-nine grains of oxygen. Titanium is a metal nearly as valuable as gold, and it crystallizes in cubes. It is very rare, and very few people know how to obtain

it from the ore. Oxygen is an invisible gas, that constitutes the greater part of the air, and makes all animals live. It is in water and a great many things. Titanium ore is very hard and heavy, and is used for painting on porcelain, and for giving the proper tint to artificial teeth. It was discovered one hundred years ago that there was a metal in it, and chemists worked on it for fifty years before they named it. When first broken, it shows crystals that are sometimes of eight, twelve, or sixteen sides, and sometimes of no definite shape. In places where it is broken, it is of a reddish-silver color, and sometimes of a dark silver color. But the lighter color is the purest, the other having a very small quantity of iron that colors it. There are some bright red spots on the broken places. Titanium is worth two hundred and forty dollars a pound, and burns with a more beautiful flame than any other metal. Titanium ore is found on the Ozark Mountains, in Arkansas, the Alleghany Mountains in the eastern part of the United States, the Himalaya Mountains in Asia, the Rocky Mountains in North America, the Andes in South America. It is also found in England and Spain.

"This ore is never found in large quantity — seldom if ever, more than a few ounces at any place."

GRADE VI.

The Beeches.

"The Beeches are a very beautiful family of trees growing in moist, rich soil. There are sixteen different kinds of beech trees in the world, but only one in Massachusetts. There are six different kinds that grow on the Andes mountains in Chili. They grow on the islands of Tierra del Fuego, New Zealand, Van Diemen's Land, and in the western part of Asia, the northern part of Europe and America. But the tallest are found in western Massachusetts and in Ohio, growing there about one hundred feet high and from two and a half to three feet thick. They also grow along the banks of the Ohio river."

The American Beech.

"The Fagus ferruginea or American beech is a very beautiful tree. The wood is of a reddish-brown color near the pith, but near the bark it is much lighter. It is quite heavy and is composed of very fine fibers. The pith-rays are rather thick, and can be seen only on two opposite sides. On the other two sides the ends of them can be seen. The tree we studied to-day is a little more than fifty years old, and for that reason it is more red than a younger tree

would be. The wood is used for plane stocks, chair-posts, saw-handles, and sometimes for shoe-lasts. The bark is light and dark gray on the outside, but golden-brown on the inside. It is very brittle, rather smooth and quite thin. There are very small black dots on it, and there are no fibers.

"The leaf varies in length from about three to five inches and is net-veined and feather-veined. It is of an ovate shape, with an accuminate apex. The mid-vein is covered with very fine hairs, which can be seen more plainly on the under side than on the upper. On the under side the veins are raised from the leaf. The margin is coarsely serrate, and there is a notch at the end of every veinlet. The margin is fringed with very fine hairs that can be seen very plainly. The stem, or petiole, is very short and crooked. The upper side of the leaf is much darker than the under side, and much smoother. In the spring, and especially when the leaf is unfolding, the under side is covered all over with hairs, and looks very pretty. The bud that contains the leaf forms in the autumn and remains on the tree all winter until they unfold in the spring. The leaves turn yellow and brown late in the autumn, but, unlike those of some other kinds of trees, they remain on until killed by frost, late in the winter. The seed of the beech tree is the beechnut, which is held and fas-

tened by a bur. The bur has four lobes and they are on two opposite sides. They are covered with little prickles on the outside, but on the inside they are very smooth. The beechnuts themselves are very smooth and there are generally two nuts in each bur. They are triangular, having three sharp sides and coming to a very sharp point. The nuts are very good to eat, and in France they press great quantities of them for the oil, which is good for flavoring different articles of food. The stem of the bur is soft and covered with very fine hairs like the edge of the leaf. The nuts are very small, being only about half an inch long, and each one of the three sides are about the same length. They are a little larger on some other kinds of beech. The stem of the bur is only about one-third of an inch long and about one-eighth of an inch thick. When the nuts are in the bur the two flat sides come together."

The Oaks.

"The Oaks are not a very graceful class of trees, but are very majestic and strong. They are distinguished for their great rough bark, the beauty of the leaves, for growing very tall and large, and also for growing very old. Some of them have been found one thousand years old. They are found in the

northern part of Africa, in Europe, in Asia, and North America. They are also found on the islands of Borneo, Celebes, Sumatra and Java. There are about one hundred and forty-four different kinds of oak trees in the world, twelve of which grow in Massachusetts. They do not grow at all in the North frigid zone, as it is too cold for them, but mostly in the north temperate zone, with a few kinds in the torrid. They very rarely grow below the Equator, and only a short distance. They grow as far north as Hudson Bay, and all over North America below there. But they grow best on rocky mountains and rocky hills."

The Quercus Rubra.

"The Quercus rubra, or common red oak, is excelled by none of the oaks in point of strength, majesty, and beauty. It grows best in Massachusetts, but grows very well in the adjoining states. It does not grow farther north than the southern end of Hudson's Bay, or farther south than South Carolina. They grow west as far as West Virginia. They grow about ninety feet high at the tallest and four feet thick. The wood is of a light reddish color, and is composed of fibers. It is of a darker color near the pith, and the wood near the pith is called heart-wood, and that near the bark is called sap-wood. The ducts are

quite large near the bark, but grow smaller as they reach the pith, until they can hardly be seen. They are on the annual rings. The pith-rays are quite large and wide. The annual rings can hardly be seen, as they are so perforated with ducts. The wood is used for a variety of things, such as shingles for barns, sometimes for ships, and timber. It is very good for floors, but it is very hard to dry. Wood that has been kept eighty years in a house will not be dry, and if burned, the sap will ooze out. The bark is of a light gray color and thin.

"The leaf is about four or five inches in length, and three inches broad at the widest part. It has nine lobes, and the sinuses are very deep and rounded. Each lobe has a very sharp bristle, and from two to four bristles on the sides. The apex is rather acuminate, and has a bristle at the end. The leaf is oval-shaped, growing larger near the apex. The petiole is red on the upper side, but is yellow on the under, and is not quite round. The mid-vein shows much more plainly on the under side than on the upper, and also the veinlets. The under side of the leaf is much the lighter. In the autumn the leaves turn to a brownish-red color, and that is one reason why the tree is called the red oak. They never turn yellow. The leaf is net-veined.

"The acorn is about one inch long and three-

quarters through, and looks as if it had been highly polished. The apex is large and rounded, and around it for about one-quarter of an inch there is a little white silky skin. The shell of the red acorn is thicker than that of the white oak, and will not shrivel up. If we cut off the shell, we find, by pinching a little, a crack by which we can pull apart the meat, and we find that the two parts are connected at the bottom by a hinge. When the acorn sprouts in the ground, this hinge forms either the trunk or the roots of the tree. The cup is composed of little scales which are pressed in so hard as to present a very smooth appearance. It is of a reddish-brown color and quite shallow. The inside of the cup is of a brown color. On the bottom there is a little cushion, which is what the acorn rests on. It is white and brown. The inside of the cup is very smooth, and around the edges it is of a bright orange color and is full of little cells like honeycomb. This orange-colored line is the inside of the scales. The stem is very short and rough, but quite thick."

The Strombus Lambis

"The Strombus lambis is a very curious and beautiful shell, but entirely unlike any other species of Strombus we have ever studied. It is of a reddish-

brown color on the outside, but the inside of the outer lip and aperture is of a bright salmon color. It is very thick and heavy. There are seven whorls, but the upper whorls are very indistinct and difficult to count. On the body whorl there are three rows of knobs, but the one nearest the suture is twice as large as the other two rows. These rows of knobs run parallel with the suture and are about one-third of an inch apart. They form, when they reach the outer lip, long spines or claws. There are six claws, and the two upper ones are about one inch long, while the others are about three-quarters of an inch long. The upper one grows out very near the apex, but curves toward the apex in such a way as to nearly cover it up. This gives it the appearance of being the continuation of the apex. The two upper claws are somewhat straight, but the others are straight only about half way, and then curve upward. Between the lines that form a portion of the claws, there are other raised lines running in the same direction. The claws are hollow. There is a canal about an inch long, at the lower end of the aperture. The base of the shell curves in, near the upper end of the canal. This part of the shell is very thin and brittle, and also translucent. There are rounded knobs on the edge of the outer lip, which are of a yellowish white color. The pillar is of the same

color as these knobs, and is very smooth. There is a light pink spot on the side of the shell near the pillar. The suture can not be seen.

"The mollusk lives in shallow water around the Japan Islands, the Philippine Islands, Borneo, Sumatra, Java, Celebes, Gilolo, Ceram, Amboyna, Timor, Sumbawa, Sumba, Socotra, Ceylon, the Maldive and Laccadive Islands, the Comoro Islands, Madagascar, Mauritius and Reunion, and on the coasts of China, Hindostan, Beluchistan, Persia, Arabia, Turkey, Somali, Zanguebar, Mozambique, Zulu Land, Natal, Caffraria and Cape Colony. There are one thousand of the Japan Islands, and they are very mountainous, some of the mountains being two miles high. The best market-places for the Strombus lambis are at Tokio, the capital of Japan, Borneo, the capital of Borneo, Manila, the capital of the Philippine Islands, Colombo, the capital of Ceylon, and Tananarivo, the capital of Madagascar. There are sixty-five different species of Strombus, and we have studied five, the Strombus Canarium, the Strombus lentiginosus, the Strombus pugilis, the Strombus melanostoma, and the Strombus lambis."

ASBESTUS

"This is a very beautiful day, but considerably

cooler than any day we have had this week. The wind blows quite roughly toward the northwest, and at about the rate of eight or nine miles an hour. It takes a good deal of dust along with it, as we have not had any rain for several days. The sky is of a light shade of blue, and there are a great many beautiful cumulus clouds, some of them being rather dark colored. We did several problems in Interest before recess this morning, and then we went out and had a very nice time. When we came in we had a lesson on a mineral called Asbestus.

"This is a very interesting as well as beautiful mineral, more beautiful than any we have had this year. It is called fibrous asbestus, because it is made up of fibers. It is always found between two banks of other kinds of rock. The fibers are of a greenish-white color, and will not burn. For this reason the Greeks and Romans used it to make napkins of, as when they became soiled, the way to clean them was to put them in a hot fire, which would burn the dirt off. They also used it for wicks for lamps, which they kept constantly burning in their temples to the heathen gods and goddesses, and it was known to burn for hundreds of years without consuming. For that reason the Greeks named it asbestos, meaning in the Greek language, not to be consumed. The people now use it for firemen's

gloves, and other things. It is of various shades of green, beautifully mixed, and when held in the light it sparkles like very bright silver. When the fibers are separated, which is very easily done, they can be twisted into a very strong cord. They are very fine, and it irritates the skin if rubbed against it. It is composed of oxygen, silicon, magnesium and calcium, but the percentage is not known for certainty, as it is very difficult to analyze. Each little fiber is a crystal. It is very heavy, but it is not known what the degree of hardness is. It is a variety of Hornblende, and the only variety that is used for anything. It is found on the Alleghany Mountains in the eastern part of the United States, Sierra Nevada Mountains in the western part of the United States, the Sierra Madre Mountains in Mexico, the Apennines in Italy, the Atlas Mountains in Morocco, in the northwestern part or Africa, the Himalaya Mountains in Asia, and the Hecla Volcano in Iceland. The market-places for asbestus are at Little Rock, the capital of Arkansas, Harrisburg, the capital of Pennsylvania, Reykjavic, the capital of Iceland, Mexico, the capital of Mexico, Sacramento, the capital of California, Rome, the capital of Italy, Calcutta, the capital of Hindostan, and Morocco, the capital of Morocco. Also Quebec, the capital of Canada."

GRADE VII.

The Ostrya Virginica.

"The Ostrya Virginica, or common Hop-hornbeam is a very beautiful tree. It is also quite graceful, as the twigs are very small. In most parts of America it is called iron-wood, but in Maine, New Hampshire, Vermont, and Massachusetts it is generally called lever-wood. It grows best at about forty-three degrees north latitude, growing there about forty feet high and one foot in diameter. It is found in all the states east of the Mississippi and as far north as the Strait of Belle Isle, the East Main and Albany rivers and Lake Winnipeg. It is the only kind of Ostrya growing in North America and there are only about six in the world.

"The bark is thinner than that of any other tree we have studied, and the outer bark is quite rough. The outer bark is of different shades of brown mixed with black, while the inner bark is of a golden brown color and very fibrous.

"The wood of the hop-hornbeam is of a light color, but the heart-wood is very nearly the color of the black walnut. It is very hard and heavy and is composed of very fine fibers. It is also very hard to split. The rays are very fine, and the ducts can hardly be

seen. The annual rings can be seen very plainly. It resembles the moose-wood, birch, and rock maple very much. It is used for the cogs of mill-wheels, mallets, and binding-poles.

"The hop-hornbeam tree has a very beautiful leaf, greatly resembling that of the birch. It is about three inches in length, and about one inch in diameter. It is of a pointed ovate shape and has a doubly serrate margin. The apex is very sharp, and the veinlets are parallel.

"The seed of the hop-hornbeam is about one-half of an inch long, including the sack which encloses it. This little sack is very thin and brittle, and is of a delicate brown color. The seeds themselves are only about one-quarter of an inch long and quite hard. The seeds grow in clusters, and the clusters are about one inch and a half in length. The seed has a very sharp apex, and is covered with fine prickly hairs. The sack is net-veined, and is translucent. The clusters of seeds greatly resemble hops, which accounts for its being named hop-hornbeam."

SIDERITE.

"This is a cold but pleasant day, and the sun shines brightly. There are no clouds in the sky. This morning there was a slight haze in the air,

making distant objects look indistinct. There is a gentle west wind blowing now.

"We have had a pleasant lesson on a mineral called siderite. This beautiful and interesting mineral is of a dark golden brown color, with cleavage faces running in three directions. It is a kind of steel ore. Massive siderite has rough surfaces, with the cleavage faces in small pieces. Siderite crystallizes in rhombohedrons, but is rarely found crystallized. It is composed of three elements, iron, oxygen, and carbon. Forty-eight per cent. of siderite is iron, forty-two per cent. is oxygen, and ten per cent. is carbon. Iron is the most useful of all metals, and the most abundant of all elements after oxygen, silicon, and aluminum. It is used for a great many things. Oxygen is the most abundant of all elements. It is an invisible gas, and supports fire, and all animal life. It makes up eighty-nine per cent. of water, and forty-five per cent. of the whole crust of the earth. Carbon is the same as charcoal, and the diamond is pure crystallized carbon. It is a very useful element. The luster of siderite greatly resembles that of feldspar, but it has a little of a metallic luster, besides the pearly. Some very smooth cleavage planes are slightly iridescent. The degree of hardness is four, a little more than that of galena, which is about three. The specific gravity is four, about

half that of galena. Siderite is often found in cryolite, and my largest specimen contains some of that mineral. I have a specimen of siderite which is of a much lighter color than the other, and contains some copper and iron pyrite which is in some places iridescent. The copper pyrite is of a very bright golden color, shading to red in some places. Siderite, when held in the light, sparkles very beautifully, owing to the cleavage faces.

"It is found in Maine, New Hampshire, Vermont, Pennsylvania, and Ohio, but not in large quantities, it being found most plentifully in Connecticut and in Greenland. It is also found in England, Germany, Austria and Russia."

The Strombus Melanostoma.

"The Strombus melanostoma is a very beautiful shell. It resembles the Strombus pugilis somewhat in shape, but it is narrower in proportion to the length than that shell, or any other kind of Strombus we have studied. It is found on the shores of the Andaman and Nicobar islands and in all the places where the Conus striatus is found. The best market-places for this shell are at Calcutta, Colombo, and Bombay. There are only sixty-five different species of Strombus in the world.

"The Strombus melanostoma is about three inches

in length and one and one-half in breadth. It is very heavy. There are seven whorls, and the apex is rather blunt. The body whorl has three rows of knobs running parallel with the suture. The one nearest the suture has longer knobs than the other two rows. The other whorls have only one row of knobs and after the two whorls nearest the body whorl they can hardly be seen. All the whorls are of a light grayish white color, but if held in the sunlight, they have a pearly luster, particularly near the apex. There are great numbers of lines running in the same direction as the knobs, which are raised. The lines of growth are scarcely perceptible. The suture is quite broad and considerably raised. The upper part of the pillar is of a rich black color shading into a bright orange, near the base. The lower half projects in toward the aperture. The inside of the aperture is also of a bright orange color in as far as we can see and is very smooth. The edge of the outer lip curves in, and is very thick. The outside is striped with white and brown. Inside of these stripes there is a brown and silver stripe, running lengthwise, while the other lines run crosswise. At the upper end of the aperture, there is a long point projecting upward. This point is about one-third of an inch in length, and is of a black color. Between this point and the shell there is a broad, deep notch

or canal of the same color as the point. There is also a very long, narrow canal formed by the base curving outward. There is, near this canal, what seems to be another canal. This is made by the lower edge of the outer lip curving backward and inward."

The Fraxinus Americana.

"The Fraxinus Americana, or common white ash, is a very beautiful tree. When young it is of a very graceful shape, but when old it is rather stiff. It grows best at about the same place as the hemlock spruce, but the very best place for them is on the banks of the Penobscot, Kennebec, Androscoggin, Merrimac, Connecticut, Hudson, Delaware, and Susquehanna rivers. The tallest are found as high as eighty feet, and three feet in diameter, sometimes growing as high as fifty or sixty feet without a limb. They are found as far south as the hemlock spruce, about as far south as the Middle States reach.

"The bark is rather thick and on the outside it is quite rough. The outer bark is of different shades of brown and gray, and there are a great many lichens on it. The inner bark is of an orange brown color and the layers are easily seen. It has rather a spicy odor.

"The heart-wood of the white ash is a very little darker than the sap-wood. The color of the wood is

a light reddish-brown, quite like that of the black cherry. It is rather heavy and fibrous. The ducts are quite large, and the silver-grain is easily seen and sparkles when held to the light. The rays are very fine. The pith is quite soft. The wood is very hard and tough, and is used for a variety of purposes, such as frames for chairs and sofas, handles for hammers, rakes, hoes, and shovels, bows, oars for boats, and other things.

"The white ash has a compound leaf, with generally five leaflets. They grow opposite on the stem, with one odd one at the top. The leaf varies in length, from six to about ten inches including the petiole. The top leaflet is much the largest, being about four inches and a half in length and three inches wide. The other leaflets are about all different in size and shape. The upper side of the leaflets is of a dark green color, but the under side is of a light silver green color. The veinlets and the midveins are raised up on the under side and are also of a very light silver color. The shape of the leaflets is ovate and pointed, and the apex is rather blunt. The margin is serrate and the teeth are rather far apart. The petiole is nearly round, and is of a light yellowish-brown color. The petiolules are very short and are of about the same color as the petiole. They

are very fine. The leaves turn in the autumn to a yellowish-brown color, and they are very thin.

"The seed resembles that of the black ash in many respects, and also differs from it in many respects. It is not so broad as that of the black ash, but is of about the same color. It is of a light greenish-yellow, and is about two inches long, and one-third of an inch broad. The seed-vessel is oval-shaped and is very thick. The seed has one wing which is parallel-veined and quite thick."

The Adiantum Pedatum.

"Our lesson to-day is upon a very graceful as well as beautiful fern, and one of the most remarkable growing in North America. It is called the Adiantum pedatum, but a more common name is maiden's hair. It grows from eight to fifteen inches in height, in rich soil, rather damp, and in shady places. It often grows in the same places with the Aspidium marginale.

"The root of this fern resembles that of the Onoclea sensibilis, and is about twice as large as the stipe. It grows horizontally on the top of the ground. The stipe is about seven inches long, and quite thick. There are several grooves on the upper side, some being deeper than others. The upper side is nearly black, but the under side is of a rich dark brown

color, and both sides are polished. The rachis is divided into two parts, each of which are again divided into five parts, called the secondary rachises. They are of a lighter color than the stipe, and are grooved. There are eleven pinnae, the longest being about seven inches in length, and the shortest only about an inch and a half in length. The frond is about ten inches in breadth, and six in height. The general shape is very much like a fan. The pinnules average about one-third of an inch in breadth, and one-half an inch in length. They are of a pale green color, and the veinlets are forking. The under side of the pinnules is not as smooth as the upper. The lower margin is entire, but the upper margin is notched, and the edge of the pinnules next the stipe is parallel to it. The stem is very short and fine. There are about thirty pinnules on the largest pinnae, and on the smaller ones about fifteen. The sori grow in a very curious manner. A small portion of the edge of the pinnule is turned over, with the sori underneath. They are crescent shaped, and are very small. It would take five hundred of them placed side by side to reach one inch.

"The Adiantum pedatum grows in all the States east of the Mississippi River, except Florida, and in Washington Territory, Oregon, California, and Utah Territory. It also grows in British America as far

north as the East Main River, in Newfoundland and as far west as Lake Winnipeg; in British Colombia, and on the islands south of Alaska. It grows in Asia in Nepaul, a province in the north of India in Mantchooria, one of the northern divisions of the Chinese Empire, and in the Japan Empire, and Kamtchatka. This makes about one-nineteenth of the land surface of the earth."

ZIRCON.

"This is not a very pleasant day, but cloudy, with the sun shining at intervals. A disagreeable snow-storm commenced Saturday afternoon, and continued a good part of yesterday, and there is a good deal of it left now. The wind is north-east, and the sky is completely covered with cumulus and nimbus clouds. Saturday afternoon I attended a public rehearsal of the Handel and Haydn Society, and I enjoyed it very much. We had a very nice time out at recess to-day, and on our return we had a very interesting lesson on a gem called Zircon.

"This is a very beautiful gem and the most expensive mineral we have ever studied. When not crystallized, it is called zirconite. It crystallizes in crystals that resemble those of quartz very much, only the crystals of quartz have six sides and eighteen faces in all, while those of zircon have only four with

twelve faces. The ends of the pyramids are very sharp. Zircon is the hardest mineral we have ever studied, its degree of hardness being between seven and eight. My specimens are about seven and three-quarters. All sides of crystals are very shiny and smooth. They are prisms with a pyramid at each end, if the crystals are perfect.

"The color of zircon is a light chocolate brown, but sometimes it is white and reddish colored. It is spotted light and dark brown in some places. It is composed of zirconium, oxygen, and silicon. In one hundred grains of zircon, there are forty-nine grains of zirconium, thirty-five of oxygen, and sixteen of silicon. Zirconium is a very beautiful metal resembling silver in color, and is five times as valuable as gold, being worth fifteen hundred dollars a pound. There has as yet been no use put to it, but sometime it may be very useful. Oxygen is a very useful gas, as it keeps all animals alive, and is in a great many minerals, in all shells and limestone, and a great many other things. Silicon is not a metal, but it is in a great many different minerals. It is very rare, and difficult to extract from the rocks. Zircon is used in jewelry, being sometimes passed off for diamonds when of a white color. When it is of a reddish color, it is called hyacinth.

"Zircon is found in the Adirondack Mountains in

New York State, the Blue Ridge, running through the western part of North Carolina, the Ural Mountains, that form a part of the boundary line between Europe and Asia, the Altai Mountains, near the central part of Asia, and Adam's Peak, one of the Ceylon Mountains in Ceylon. The market-places for zircon are at Albany, the capital of New York State, Raleigh, the capital of North Carolina, St. Petersburg, the capital of Russia, and Colombo, the capital of Ceylon."

Birds.

"It is very warm and pleasant today, and everything seems fresher for the recent rain. The sky is of a very delicate shade of blue, and there are a number of stratus and cumulus clouds which look very beautiful mixed with the blue. The air near us seems clear, but if we look off for some distance it seems hazy. There is a gentle south-west wind blowing at the rate of about five or six miles an hour. The trees are beginning to have large buds, and I think they will soon show blossom.

"We have had our first lesson on birds for this year, and the subject today was the Night Heron. It is a very interesting as well as beautiful bird, and is called by that name because it travels only in the night. It is about sixteen inches high, and eighteen inches long. The back is of a rich black color with

a green gloss. The wings are of a delicate gray color, and the throat and neck are white, also the breast. The crest is of the same color as the back, and there is a streak of black running from the crest across the neck to the back. There is a plume consisting of three small ones twisted together, reaching from the crest to the back. The bill is black, and the upper mandible projects out a little farther than the lower. The upper mandible curves downward, and the point is very sharp. The tail is rather short, and is made up of twelve white feathers. The legs are covered with feathers down to the first joint, and they are quite large. The feet are made up of four claws, three at the front and one at the back.

"The Night Heron feeds upon the frogs, lizards, insects, fishes, and mice, which he swallows whole. There are four eggs, and they are of a delicate sea-green color, and are about two inches long and one and one-half in thickness. They are found at or near the mouths of the Colorado, Brazos, Trinity, and Sabine rivers in Texas, the Mississippi and Pearl rivers in Louisiana, the Appalachicola and St. Johns rivers in Florida, the Mobile River in Alabama, and all the southern rivers up as far as the Roanoke River, in North Carolina. These are their winter homes, but in summer they go as far north as the Penobscot River in Maine, and no farther. They live in the marshes and all wet places."

GRADE VIII.

The Juglans Nigra.

"The Juglans nigra, or common black walnut, is a very beautiful tree, the largest growing as high as ninety feet and five feet thick. There are two kinds of walnut growing in Massachusetts and only about six in the world. The black walnut grows in Massachusetts about one hundred miles from Boston, but grows best in Ohio, along the banks on both sides of the Ohio river. It also grows on the banks of the Alleghaney and Monongahela rivers. It grows as far north as Massachusetts, and west of the Alleghaney mountains it grows a little farther north, about forty-four degrees north latitude. On the numerous islands of the Ohio river they are found very plentifully, fully as well as anywhere in the country. It does not grow farther west than the Mississippi, and is not found anywhere in the old world.

"The bark is of a light gray color and the layers can be seen very plainly. The inner bark is of a dark brown color and quite fibrous.

"The wood, when green, is of a light color, near the bark, but near the pith it is very dark brown. When the tree grows older the wood turns darker, and when the wood is dried it turns to a dark brown

color. The rays are very fine indeed, and also the ducts. The wood is rather heavy and tough. It is used for various purposes, such as bureaus, wardrobes, brackets, book-cases, chairs, tables, gun-stocks, and picture frames. In that part of the country where the walnut trees flourish, the wood is sometimes used for fences, as it will last a great while.

"The black walnut tree has a compound leaf, with a variable number of leaflets. The leaflets are of a pointed ovate shape, and are net-veined and feather-veined. The margin is serrate and the veins show very plainly. The mid-vein is very nearly round, and is of a dark brown color with tiny white hairs. The leaflets are opposite on the mid-vein. The leaf is generally about one foot long, sometimes more. The petiole is about four inches long, but the petioles of the leaflets are very short indeed. The leaflets are about two or three inches long and are lighter on the under side than on the upper. One reason why the black walnut tree is so graceful is because the leaves are so long and have so many leaflets. When the leaves are full of sap they are quite fragrant. In the autumn the leaves turn to a yellowish color.

"The walnut is very large and very nearly round. The epicarp, or outer shell, is quite thick and hard, and is rough and pebbly. When the nut is on the tree the epicarp is green, but when dry it is of a light

and dark brown color. The endocarp, or inner shell, is very hard and bony, and the nut resembles the hickory nut. The name that is commonly given to the hickory nut is walnut, but that is not correct. The hickory nut is much smaller than the walnut. The walnut is about two inches in diameter, and four or five inches round it every way. It is quite heavy."

The Oxide of Aluminum.

"This is a beautiful day, warm and sunny. There are a very few stratus and cumulus clouds in different parts of the sky, and they look like banks of snow. The sky is of a delicate shade of blue, and there is quite a rough wind blowing, making it very dusty. There has been no rain for more than a week. The grass is quite green, and the crocuses look very pretty mixed with it. There have been a few mayflowers brought in from the country for sale, but they are not plenty as yet. The robins have been here for about a week. I attended a very beautiful concert last Friday afternoon, which I enjoyed very much. We studied a mineral to-day called ruby sapphire.

"This is a very beautiful and interesting gem, commonly called ruby. A ruby from five carats (or twenty grains) upward is worth more than a diamond of the same size, but small diamonds are worth more than small rubies. The degree of hardness of ruby

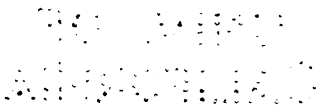
is nine, the hardest mineral we have ever studied. It is of a beautiful pink color of different shades, the larger ones being of a deeper color than the smaller ones.

"Ruby sapphire is composed of oxygen, aluminum and chromium. In one hundred grains of ruby there are fifty-three grains of aluminum, forty-six and one-half of oxygen, and one-half a grain of chromium, which gives it the color. All the varieties of sapphire have the same composition, and are all colored with chromium, giving sometimes a green color, then called emerald sapphire, sometimes a yellow color, then called topaz sapphire, sometimes of a blue color, the sapphire itself, and sometimes of a purple or violet color, called amethyst sapphire. The emerald sapphire is so rare that it is rarely seen, but still it is not so expensive as the ruby sapphire, the most expensive of all the varieties. It crystallizes in rhombohedrons, variously modified. The difference in color in the different varieties of sapphire is according to the quantity of chromium. Aluminum is a very beautiful silvery metal, very light, and easily bent. If we should burn it in oxygen, which is very difficult to do, the ashes, or remaining portion, would be the same substance as ruby sapphire. Oxygen is a very useful invisible gas, which sustains fire, keeps all animals alive, and is in a great many different

kinds of minerals and in all shells. It is colorless, tasteless, and odorless. Chromium is the coloring element in a great many minerals. Ruby sapphire is used for various articles of jewelry, and, when set, is very beautiful.

"Ruby sapphire is found on the Alleghany Mountains in the western part of North Carolina; on the Himalaya Mountains, the highest in the world, in the northern part of Hindostan and Indo-China, which is where my specimens came from, and where all the finest specimens are found. It is also found on the Auvergne and Cevennes Mountains in France, the Carpathian Mountains in the central part of Austria, and the Ural Mountains on the boundary line between Europe and Asia, though rubies are mostly found on the Asiatic side. They are often called oriental rubies, from their being found mostly in India. The ruby mines are owned by the government, and a large reward is often paid to those who find the valuable ones. When an exceptionally large one is found, the King has a great celebration and procession, and the men of high rank ride on elephants. The market-places for ruby are at Bankok, the capital of Indo-China, a very large city; Paris, the capital of France, on the River Seine, a very beautiful city; Lyons, in the central or southern part of France; Dresden, on the River Elbe, also a beautiful city; Moscow, in the

central part of Russia, distinguished for the largest bell in the world which is rung, weighing fifty-nine tons. There is one weighing two hundred and fifty tons, which is never rung. Also Raleigh, the capital of North Carolina, and Trenton, the capital of New Jersey."



PART III

SCHOOL REPORTS

SCHOOL REPORTS, SECTION I

SINCE in my attempt at the District School Meeting to make a report of the condition of the High School, together with a brief reply to several unreasonable attacks and malicious charges against me, I was frequently interrupted and compelled to withdraw in the midst of my remarks, I therefore respectfully submit to the legal voters of District No. 1, the following report, omitting the greater part of that portion which I succeeded, under many difficulties, in giving verbally.

I will first reply to some of the numerous errors in the statements of the chairman of the committee in his report. On the second page of that document I find the following :

All teachers in this town have been furnished with registers, and all, with one exception, have returned them. Your committee have just been informed that the teacher of the high school has never returned a register nor suggested any excuse for not returning them. Your committee supposed until now that they had been duly returned to the superintending committee of the town. We venture to hope that this useful law will not be nullified hereafter.

I beg leave to say that in this charge there is not one word of truth. I have been furnished with only one register annually, and that has been duly returned with all the facts required by law. I can easily prove this by inserting a statement by Mr. Averill, who has for many years been the superintending committee of the town.

I have annually sent to Mr. Whittemore one school register with the request that he would furnish me with answers to the questions therein contained, and he has returned it, promptly, with such answers.

C. S. AVERILL,
Superintending School Committee of Milford.

Instead of neglecting my duty in this respect, I have done more than the law requires. I have, each term, at my own expense, published one hundred and fifty copies of the statistics required by law, together with many other facts of interest, and have furnished both the committee and each scholar with a copy, so that every family that had a child in school might have a complete record of every term.

If any one has neglected his duty or failed to understand it, the chairman of the committee is the man. It was his duty to furnish the teachers of District No. 1 with registers sufficient to record the name of every scholar. This would require two in the high school each term, but he has never fur-

nished one. There is no law that requires a teacher to fill registers which the committee have never furnished. May we not venture to express a hope that our committee may hereafter have a chairman that will both know and do his duty?

On the third page of Mr. Wadleigh's report the following statement may be found:

> As to the "model classes" of small children in the high school—it may be proper to state that your committee objected in the beginning to the formation of such classes, on the ground that, however desirable they might be in some respects, they would injure the cause of education by creating jealousy and discord in the district. They finally yielded, however, to the wishes of the principal and consented to the establishment of one class with eight members. Now there are in the high school three classes containing twenty-four members. The main argument used by the principal in their favor was, that they were necessary to carry out a grand experiment which he was making here, which would result in establishing a new method of teaching, called by him the "normal" method, and in supplanting and overthrowing all other existing systems of education.
>
> As to the weight of this argument, your committee will give no opinion.

It may be well for our committee to suspend the expression of their opinion, at least until they have seen our classes work for an hour or so, and it may not be necessary for them to say a word about it at all, since an opinion has been expressed so frequently on this point by such men as Pestalozzi, Mayo and

Herbert Spencer in Europe, and Agassiz, Russell, Colburn, Calkins, Sheldon and other educators in America.

These distinguished men, as well as many others, have spent their lives in introducing throughout Europe and America the principles of educational science and reform which I have, with such ability as was given me, humbly sought for the last twelve years to inculcate in the minds of the young people of Milford. It may not be improper to state here that my education was directed by several of the above named men, at normal schools and colleges, for some years before I came to Milford, and that I was appointed by them to do the work somewhere, that I have been doing in Milford.

Society has nowhere recognized progress as a primary principle of natural law. Kings still strive to reconcile their subjects to effete systems of government. Obedience to old forms is held forth as a virtue. Like natural organisms, every human device must have a growth; it cannot be born perfect. The more complicated it is, the slower its growth must be.

But there are those in every community who imagine the "Ark of Truth" to be endangered whenever any change is made in the management of any branch of human interests. Opposition is awakened, as if truth could be overthrown by error. They

think that everything is about to be lost when all is to be gained.

Is not the knowledge of truth progressive? Is there not a principle within us which, when once awakened, craves for progress and cannot be satisfied without it? However great our progress, this urges us on to still greater achievements, and there is no reason to believe that our methods of carrying on human industries will ever cease to be superseded or improved. There can be no end to discoveries in nature, for the great Architect conceals nothing. Upon every natural object is written, by the Creator, its history and its use. We may not always read aright, for we live in the infancy of systematic inquiry. We are not satisfied with things as they were thirty year ago. At that time only the favored few could, for instance, possess the likeness of his nearest friend, and that was made by the devious hand of man. Behold the change! One of nature's forces now does the work. That agent which darts forth from world to world throughout immensity and, commanded by Omnipotence, lights up the universe, marshals the elements into forms of utility and beauty, and covers the hills and plains with waving grasses and flowers of every hue. Under the directing hand of the modern artist the agent that paints the rainbow paints alike the pictures of friends and of scenery,

and adorns and enlivens our homes, almost gratuitously, with the lineaments of a hundred familiar faces. Another force is caught by the hand of science, and bid to carry intelligence, swifter than light, from continent to continent. Another is made subservient by propelling our vehicles rapidly over every land and every sea. So it is in all the arts and all the sciences which give rise to art. We must extend the knowledge of our predecessors and correct their errors. Our errors will be corrected by our successors, and theirs by those who succeed them.

In regard to the "grand experiment," I will here state that I have never used the word experiment in speaking of the model classes. The experimenting was all done years ago. Moreover, there has never been much experimenting connected with the normal system, for its principles are founded in the laws of nature, and we have only to discover them as they exist and always have existed there. Are not the spontaneous processes of mental evolution, as we pass on from early childhood to age, regulated by the immutable laws of nature, as well as the growth of a plant, or the revolutions of the planets? Give the child lard instead of bread and alcohol instead of milk and his body becomes diseased and soon dies, because its treatment is abnormal. So it is with the mind. If its treatment should be altogether abnormal those

embryo germs which are susceptible of infinite expansion could never be developed. Give the child a mixture, half milk and half alcohol, and let its mental food also, be in part normal and in part abnormal and the result is just that condition of the human race that now exists about us and all over the world. It can scarcely be said that one person in a score makes a success of life. In directing the child's education no one can determine in every particular just what is the right course. But if we make use of the knowledge of our predecessors and our contemporaries over the world, may we not make some approximations toward a perfect scheme? The knowledge possessed by those who have systematically studied this subject for many years is sometimes called the science of education, and those who apply the principles of that science in teaching are said to teach normally. It has no reference necessarily to making teachers; that is only one of the results. All teaching is either normal or abnormal, that is, it is in harmony with the natural laws of mental evolution, or else it violates those laws.

The study of the objects, facts and phenomena of nature is the normal, and therefore the most congenial employment of the opening mind, and one of its purest sources of pleasure. Without such study, the mind becomes vague and abstracted in its tendencies and habits, life lacks reality, character solidity, and faith a foundation. The misdirected

culture which commences with the study of language, thence proceeds to gather thoughts, and at last reaches objects only to hurry over and slight them leaves the mind wanting in the vital elements of truth.—*Russell.*

The natural inquisitiveness of the child's mind, every one must have observed. How early he begins to investigate the objects about him, asking numberless questions. But how few of those whose work it is to rear and foster the young mind, heed the promptings of nature How often is the great book of nature sealed to the little inquirer, and his attention turned to objects of less interest. And how few there are who retain to mature years the innate desires for knowledge which were so apparent in early childhood. How many there are whose minds become perverted, benumbed, and degraded by mismanagement, all desire for knowledge obliterated, all taste for the pleasures of a rational life utterly destroyed. Yet their young minds were fitted by their Creator to study his visible works and rise higher and higher in the scale of being, until they could read in the stars that nightly shine above their heads, in the rocks beneath their feet, and in the plants and flowers that deck their way, the thoughts impressed upon them by the Great Author of all.

There has been much discussion upon the system adopted in the high school, of entrusting the hearing of the recita-

tions of their own classes to female pupils, while the teacher sits by as an observer or engaged in reading.

To such a puerile slur as this I consider it unnecessary to make any formal reply. The design of the writer is everywhere obvious. But he sets the matter right in the next sentence and nullifies his own objection.

Upon careful consideration your committee regard this method of teaching as an advantage to the young ladies who act as teachers, but as injurious to all who do not. It is beneficial to those who least need assistance and injurious to those who most need it.

Then it is clearly an advantage to every one in the senior class, and every one in the junior class, for all alike have stood before the class to conduct the exercises, one just as often as another. The recitation is never wholly entrusted to the pupils, but only so much of it as I have deemed advantageous to them. During that part of the recitation conducted by the pupils, I have endeavored to have the class feel that the whole responsibility rested on them. This form of recitation is for the purpose of inculcating self-possession, self-reliance, dignity, easy manners and thorough scholarship. The pupil questions the class upon the lesson without the book, that is, asks original questions. This makes the best possible test of a good lesson on the part of the questioner. It also

impresses upon the mind of the questioner every fact upon which he interrogates the class, and thus tends directly to make thorough scholars. Whenever the class fails to penetrate and develop a principle in the lesson, I am always present to do such work as they fail to do. A principle of educational science is involved in this method. It is well expressed by Thomas Eubank, in the following lines:

> No fact is more prominent, in the economy of the world than that *man was to have nothing—absolutely nothing—done for him which he could possibly do for himself. This was essential to the development of his character.* Had it been otherwise, metals had been dug up in the forms of useful instruments, and articles of furniture had been the natural fruit of trees. Vegetable fibre had grown in hanks of thread and in woven garments, glass and stone ware had been quarried, and articles of furniture had been the natural fruit of trees. All substances would have been found in the most useful form.

To speak of a want of interest in the class when this method is pursued, is extreme folly, and is in direct opposition to the testimony of every candid observer of our recitations. I have been unable, as yet, to practice this method completely in the lowest class as that class has been the receptacle of scholars coming every term from schools in which they have had no normal training. The model classes are fully under way in this method, and the only part of the school which does not please the committee is that

very part which I have been unable to bring under the normal plan.

The principal of the high school has, for years, assumed the right to admit into and exclude from the high school such scholars as he chose, and rather than bring on a conflict with him, such as is now agitating the district, committees have abdicated their legal duties.

I have always understood perfectly the duty of the committee in regard to transferring scholars from one school to another, and have never assumed the right to admit into or exclude from the high school any scholar and never have transferred a scholar without the direction or consent of the committee. The committee have sometimes desired me to do it, but I have refused to take the responsibility.

Your committee then sent to him, a request in writing, to admit those five scholars. He admitted four of the five and one other whom he was not directed to admit, but excluded one of the five—James Hanrihan—whom your committee deemed particularly worthy of admission. Upon application to him to state the reason why Hanrihan was not admitted, he said he had no seat for him.

In this paragraph, and all that follows to the end of the committee's report, nearly every sentence is full of error. It is strange that a man can warp the truth so constantly. I will insert *verbatim* the first order from the committee.

Milford, N. H., Sept. 4th, 1866.

WILLIAM L. WHITTEMORE, ESQ.—Dear Sir: Please admit to the high school the following scholars from the grammar or intermediate school the present term: James Hanrihan, Arthur Towns, William French, Bell Mills, Kate Mills, William Tarbell.

Signed, B. Wadleigh, S. Smith Stickney, W. H. W. Hinds, T. Kaley.

I had at that time about one hundred scholars, which is considered in most other places as many as can be properly taught by three or four teachers. The high school was larger than it had ever been before, while the grammar school was not nearly as large as it had sometimes been, and it was well classified. If scholars were promoted a new class must be formed, which would make it exceedingly inconvenient to carry on the work in the high school. Moreover, there were at that time only four unoccupied seats in the high school, one on the girls' side and three on the boys' side of the room; so I concluded to do the best I could under the circumstances, and accordingly admitted the three oldest boys and the older of the two girls, but the girl declined coming in as her sister could not come with her. There was plainly no seat for the youngest boy unless I put him with the girls. The talk of his being refused admission because he was an Irish boy is a malicious falsehood. I never thought of such a

thing. I had previously inquired of the chairman what I should do when the seats were all taken. He said "close the doors of course"; and I simply carried out the order. I could not see why a class in the grammar school should be divided and the poorest scholars sent to the high school and put to work in higher books, while the best ones were retained in the grammar school and put into lower books. But that is just what was done, and I have the means of proof. When, as a citizen, interested in the rights of the scholars in both schools, I raised a question or two about it, I was told that I had "nothing to do about it;" that I was "paid for my services," and I "need not be so conscientious about it." They took it for granted that I was a hireling. I have never acknowledged myself a hireling in educational matters, although the attempt has often been made to compel me to act like one, and to give up all sense of right, in order to please A, B, and C. Here is where the difficulty all comes in. The three or four men who have been so busy during the past few weeks, never tell their real objection, but go about with falsehood on their lips, telling what "they say." These men have acted the part of "coward calumny" that always "stabs in the dark." The only man who has had the fairness to state his grievance publicly, for the last ten years, is Mr. Xenophon Mills. He

acted the part of a gentleman and I honor him for the manly act.

For the reason that the public money can be used to publish only falsehood "for the use of the district," and also because I do not wish to put in print any more records of the proceedings of the last few months than is really necessary, I suspend publishing, for the present at least, several pages of manuscript relating to the disgraceful proceedings of last September. I will simply say that I did protest earnestly, as a teacher and a citizen, against a course which so completely ignored the sacred rights of others. I did not refuse to comply with any legal order of the committee, until I was ready to resign the charge of the school. The chairman, through that whole disgraceful affair, seemed to have only one idea in his mind, and was willing to sacrifice the rights of a hundred families in order to please a woman who comes with unreasonable demands, accompanied with a threat. I was reminded through the whole affair of a man who lived some centuries ago, named Herod.*

He was asked to admit but five and admitted five without claiming any increase of wages. He refused to admit one who had been transferred and did admit one who had not been transferred.

*See Matt. 14: 1—12.

I will correct the error in these two sentences. I was ordered, as I have shown above, to admit six. I did not admit one without claiming an increase of wages. I refused to admit two of the six because there were no seats for them, and thereby followed the direction of the chairman. I did not admit one who had not been transferred, as may be seen by the committee's first order.

I agreed with the prudential committee at the beginning of the year to teach one year on conditions, and the promotion of scholars from the grammar schools nullified the contract. I was twice re-engaged and at an increase of salary each time.

This is a sample of the whole report, and I now assert, openly and definitely, that the whole document is pregnant with falsehood. And malicious as that falsehood appears, it is very mild when compared with that which a few other men have carried about the district during the past winter, whispering it in the ear of every man who was not acquainted with the facts. Many of these men, not knowing the facts of course, were made to believe what they heard repeated so often. I do not censure them; they were as ready to believe the truth as falsehood, if it were only told them. Such infamy should have stamped upon it "the indelible stigma of the public abhorrence." This falsehood called out nearly a hundred

men to break up a school which has cost the earnest effort of one man, at least, for twelve years.

In regard to the members of the board whose names are found on Mr. Wadleigh's report, I would say that I feel somewhat inclined to make apology for them. I think they really meant no harm. I suspect they didn't know much about school matters; that they did not take the trouble to investigate the merits of the document to which they subscribed, any more than they have the merits of the school since the citizens of the district honored them by making them supervisors of the highest interests of their children. Let us see how the case stands. Three of these men have seen nothing, as it were, of the school for the past two years. Another sometimes come examination day. The chairman has been in school often enough, but he always comes when a certain class of young ladies is about to recite. He has never seen one half of our classes, and probably has not seen a dozen different schools for a quarter of a century. The fact is these gentlemen, in educational matters, are forty years behind the times. They have not yet discovered that there is anything to be known in school polity, beyond what any one may know intuitively. They recommend a method of teaching which was exploded among all intelligent educators thirty years ago.

Dr. Hinds has seen more of the high school than any other member of the board, and has evidently comprehended the "situation."

Before closing I wish to express my thanks to a very few of my indulgent neighbors for the great kindness they showed me in allowing me to say a few words at the annual meeting. I thank them particularly, because they did not interrupt me any oftener. That act of courtesy and consideration saved me, at least, ten dollars that I otherwise must have paid for printing those facts, which some men were evidently afraid to hear.

W. L. WHITTEMORE.

Milford, March 30, 1867.

SECTION II

To comprehend the laws of nature is the grand object of intellectual culture. The fatal error in the educational schemes of all ages has been the futile attempt to ornament the mind without informing it. Hence the world has but just discovered even the existence of those laws, whose daily violation for ages past has rendered a world of surpassing beauty and perfection a great sepulchre for the premature dead, and an abode of suffering for millions who linger through maturer years. Of all systems of education that is the best which furnishes the most perfect guidance to complete living. A right mode of teaching contravenes none of nature's tendencies; but it excites the activity of the mind in accordance with the laws which control its spontaneous development, and thus co-operates with nature in her plan of unfolding the faculties. There can be no success when we contravene nature's laws, whether we deal with tangible objects or with human minds. Overlook her laws in inanimate material, and the awful wreck of life and property in the downfall of the Pemberton Mills is an example of the penalty. Ignore her

laws in the human body or mind, and who can calculate the inevitable result, as it widens down the ages? Ignorance of the laws of life confers no exemption from the failure and suffering consequent upon their violation. Nature's inexorable and unpitying penalties are meant to coerce us to the study of her works, when their exceeding beauty fails to allure our attention.

That system which requires the thorough study of the science of education, and seeks to determine what each step in the educational process ought to be, by a knowledge of the laws of human nature, is called the normal system. Founded upon biological and psychological science, educational philosophy is, and must be, progressive in its development. Normal schools which have thus far been established, differ so widely in their general plan that they may be best considered under three grades. First, normal schools with no model classes. Second, normal schools with transient model classes for the purpose of illustrating the true mode of teaching. Third, normal schools with permanent model classes, trained, or to be trained normally, through their whole scholastic course.

The first and second grades include the state normal schools. The true function of these schools is to make the establishment of still better normal

schools a possibility. They may be considered pioneers in the great educational reform which is slowly taking place. Our own state should lose no time in establishing one good normal school. The fact that this has not yet been done shows that our people need to be aroused if not enlightened on the demands of education. But state normal schools can never furnish the thousands of rural districts all over our land with their graduates. These schools will be taught generally by young persons who will enter the profession for only a few years. Moreover, the course of training at the state normal schools is insufficient to confer anything like a clear understanding of educational science upon scholars who have been trained in the ordinary way till the age of eighteen or twenty years, before entering upon the normal course.

The third great step in the development of normal schools is the founding of an order of institutions which shall train the child, in accordance with nature's laws, from the day he enters school till he graduates. In villages of less than ten thousand inhabitants our schools, everywhere, are in a deplorable condition, and will remain so until their whole plan is changed. The design of the village normal school is to furnish such places with the means of a thorough and rational culture instead of the jargon of the pres-

ent time. To reconstruct our village schools will require a very long time, for teachers to do it are yet to be educated.

Having had a little experience in the first and second grades of normal schools, and subsequently having pursued, for years, the inductive study of educational philosophy, under a well organized plan, it has devolved upon me to present, if I can, a model of the village normal high school.

Even while the system is but partially introduced, our graduates are successful competitors with the graduates of the best normal schools of New England. Of the ten who have already completed the course, two are teaching in Boston, two in the annual schools of Milford, and three have taught in Amherst during the past year.

From the dawn of civilization to the present day, the most beneficent schemes for human advancement have been scowled upon with malignant hatred; but the obsolete absurdities of former ages must soon be abandoned. The progressive evolution of our race goes on by nature's command, and her commands are never nullified.

In the prevailing schemes of education, the time of teachers and scholars is given mostly to the lingual and mathematical studies, while that transcendent order of truth which alone can illuminate our way in

the world, is practically ignored; and the recipients of our boasted education must grope their way in darkness, stumbling at every step in a world of light and order, because they are unable to read the language of the Infinite, which he has written in living characters upon every object and every phenomenon around us.

Language and mathematics are very useful branches, but are to be studied as a means and not an end. They are indispensable at every step in the educational process, as a means of discovering and expressing real knowledge and when put to their legitimate uses, they will be learned most effectually, by using them. The normal method confers by far the best mental discipline, as well as the most available culture in language and mathematics. To these it adds a thorough and practical knowledge of the sciences of nature; and all for half the cost of ordinary education. The reason is obvious, — science directs in one case, and the dictates of tradition and empiricism in the other. Jackson's battle at New Orleans had not been heard of in all the States, thirty days after it was fought. To-day thirty minutes would almost suffice to send the intelligence over the civilized world. A single application of science has wrought the marvellous change! And can science do nothing for education? Are not the human mind

and body a part of nature's dominion, and subject to her laws?

Nature's ways are everywhere models of economy. By one simple means she accomplishes a thousand grand results. She lights and warms, irrigates and animates, and holds in never-ending cycles a hundred worlds by one central fire.

The normal course of scholastic education, begins in the systematic training of the child, into habits of careful and minute observation. While curiosity is awake, the child is led to appeal directly to nature for information, and by observing personally, her objects, facts and phenomena, there is awakened within him, such a love of knowledge, as the prevailing methods of teaching can never inspire. Beginning in the concrete and simple, with familiar objects, drawn from a single science or department of nature, we proceed by gradual steps toward the complex and abstract, and to objects more remote and varied. Losing no time for mere mental discipline, the scholar gains the highest possible discipline, in the acquisition of the most useful knowledge.

But it is not my design to try to show what the normal system is in these few sentences. Hundreds of pages would be required to convey anything like a clear idea of all its processes. Let it suffice, for the present, to say that its principles have been ad-

vocated by the leading educators of all countries. Among the foremost we find Comenius, Pestalozzi, Neiderer, Krusi, Fellenberg, Zeller, Diesterweg, Cousin, Jullien, Tyndall, Henfry, Agassiz, Russell, Sheldon, Calkins, and all other educators as far as I am acquainted, who have devoted even a few years, to the inductive study of educational science.

"The predominant culture of modern times had its origin, more than eight hundred years ago, in a superstition of the middle ages. . . . This scheme has been handed down from age to age, and with but slight changes, still predominates in the higher institutions of learning, and still powerfully reacts upon the inferior schools. . . .

"The ancient philosophers held that it was as degrading to seek useful knowledge as to practice useful arts; hence, subjects of study were chosen as intellectual gymnastics. Under these circumstances no vulgar question of economy could arise; mental power was ostentatiously wasted, and with the necessary consequences—truth unsought was not found; the ends of culture being ignored, there was neither conquest of nature nor progress of society. . . .

"In childhood there is a vast capability of accumulating simple facts. Skilful guidance at this period is of the very highest importance. When curiosity is freshest, and the perceptions keenest, and memory most impressible, before the maturity of the reflective powers, the opening mind should be led to the art of noticing the aspects, properties, and simple relations

of the surrounding objects of nature. This should be guided into a growing habit, and the young pupil gradually trained to know how to observe, and what to observe among all the objects of its unfolding experience. It should be encouraged to collect many of the little curiosities which awaken its attention, and required carefully to preserve them; but to do all this judiciously is delicate work. The custodian of the child must know something of the objects of nature, and much of the nature of the young pupil. Above all things, teachers qualified to do this work are the desperate need of the age. To perfect the object-method, and train instructors to its discriminating use, is one of the great functions of normal schools, and must become the practical basis of a rational system of education. Let it be remembered that there is nothing forced or artificial here; the scenes of childish pleasure and exuberant activity furnish the objects of thought. In creating an interest in these things a bent is given in the true direction; the valuable habit of observing and seeking is formed while the numberless disconnected shreds of knowledge are incipient acquisitions, which will grow with time into the ripened forms of science. . . .

"When nature becomes the subject of study, the love of nature its stimulus, and the order of nature its guide, then will results in education rival the achievements of science in the fields of its noblest triumphs. Man's first and his life-long concern is with his environment, the objective universe of God. It is a realm of law, and therefore he can understand

and control it: a scene of irresistible forces which crush him if he is ignorant, and serve him if he is wise. . . .

"The overshadowing error of the present education, is the propensity to accept words in place of the ideas and things for which they stand, and from which they borrow all their value. Words are the vehicles of thought; so much of the study of language, and in such forms as are necessary to its intelligent use is demanded in education. But the lingual student, captivated by the interest of word studies, loses the end in the means. A plough was sent to a barbarian tribe: they hung it over with ornaments, and fell down and worshipped it. In much the same manner is language treated in education. . . .

"So long as little was known of the order of the universe, little could be understood of him in whom that order culminates. And here I call attention to the deep defects of that predominant scheme of culture which not only ignores the human brain, and the sciences which illustrate it, as objects of earnest systematic study, but explodes upon it all the traditional contempt which it cherishes for material nature. Men admire the steam-engine of Watt and the calculating engine of Babbage, but how little do they care for the thinking engine of the Infinite Artificer! They venerate days, and dogmas, and ceremonials; but where is the reverence that is due to the most sacred of the things of time, the organism of the soul! . . .

"A knowledge of the being to be trained, as it is

the basis of all intelligent culture, must be the first necessity of the teacher. Education is an art, which may be pursued empirically or rationally, as a blind habit, or under intelligent guidance; and the relations of science to it are precisely the same as to all the other arts—to ascertain their conditions, and give law to their processes. What it has done for navigation, telegraphy, and war, it will also do for culture. The true method of proceeding may be regarded as established, and many important results are already reached, though its systematic application is hardly entered upon.

"Our teachers mostly belong to the old dispensation. Their preparation is chiefly literary; if they obtain a little scientific knowledge, it is for the purpose of communicating it, and not as a means of tutorial guidance. Their art is a mechanical routine, and hence, very naturally, while admitting the importance of advancing views, they really cannot see what is to be done about it. When we say that edution is an affair of the laws of our being, involving a wide range of considerations, that it involves that complete acquaintance with corporeal conditions which science alone can give, we seem to be talking in an unknown tongue, or if intelligible, then very irrelevant and unpractical. The imminent question is, how may the child and youth be developed healthfully and vigorously, bodily, mentally, morally; and science can alone answer it by a statement of the laws upon which that development depends. Ignorance of these laws must inevitably involve mismanagement."
—*Prof. E. L. Youmans.*

"No human pursuits make any material progress until science is brought to bear upon them. We have seen, accordingly, many of them slumber for centuries upon centuries; but, from the moment that science has touched them with her magic wand, they have sprung forward, and taken strides which amaze and almost awe the beholder."
—*His Royal Highness, Prince Albert.*

"Modern civilization rests upon physical science; take away her gifts to our country, and our position among the leading nations of the world is gone to-morrow; for it is physical science only, that makes intelligence and moral energy stronger than brute force. . . . I believe that the greatest intellectual revolution mankind has yet seen is now slowly taking place by her agency. She is teaching the world that the ultimate court of appeal is observation and experiment, and not authority; she is teaching it to estimate the value of evidence; she is creating a firm and living faith in the existence of immutable moral and physical laws, perfect obedience to which is the highest possible aim of an intelligent being.

"But of all this your old stereotyped system of education takes no note. Physical science, its methods, its problems, and its difficulties, will meet the poorest boy at every turn, and yet we educate him in such a manner that he shall enter the world as ignorant of the existence of the methods and facts of science as the day he was born. The modern world is full of artillery; and we turn out our children to do battle in it, equipped with the shield and sword of an

ancient gladiator. Posterity will cry shame on us if we do not remedy this deplorable state of things. Nay, if we live twenty years longer, our own consciences will cry shame on us.

"It is my firm conviction that the only way to remedy it is to make the elements of physical science an integral part of primary education. But let me entreat you to remember my last words. Addressing myself to you, as teachers, I would say, mere book learning in physical science is a sham and a delusion —what you teach, unless you wish to be imposters, that you must first know; and real knowledge in science means personal acquaintance with the facts, be they few or many."

—*Thomas H. Huxley, F.R.S., LL.D.*

"Herein at present lies the main difficulty concerning the introduction of the science of observation into courses of ordinary education — a grade of teachers who should be able and willing to carry science into schools for youth has hardly yet appeared. Hitherto there have been few opportunities for their normal instruction."—*Professor Edward Forbes.*

"Normal schools for the preparation of teachers must necessarily be an essential part of any well-ordered public school system. The rule under which they should not only be taught, but likewise subsequently teach — the rule that should be made to apply in every establishment, from the primary school to the university, is this — education should represent the existing state of knowledge.

"But in America this golden rule is disregarded,

especially in the case of the higher establishments. What is termed classical learning arrogates to itself a space that excludes much more important things. It finds means to appropriate, practically, all collegiate honors. This evil has arisen from the circumstance that our system was imported from England. It is a remnant of the tone of thought of that country in the sixteenth century; meritorious enough and justifiable enough in that day, but obsolete in this. The vague impression that such pursuits impart a training to the mind has long sustained this inappropriate course. It also finds an excuse in its alleged power of communicating the wisdom of past ages. The grand depositories of human knowledge are not the ancient, but the modern tongues. Few, if any, are the facts worth knowing that are to be exclusively obtained by a knowledge of Latin and Greek; and as to mental discipline, it might reasonably be inquired how much a youth will secure by translating daily a few good sentences of Latin and Greek into bad and broken English. So far as a preparation is required for the subsequent struggles and conflicts of life, an ingenious man would have no difficulty in maintaining the amusing affirmation that more might be gained from a mastery of the game of chess than by translating all the Greek and Latin authors in the world."—*Professor J. W. Draper, of the University of New York.*

"Our whole system of instruction requires an honest, thorough, and candid revision. It has been for centuries the child of authority and precedent. If

those before us made it what it is, by applying to it the resources of earnest and fearless thought, I can see no reason why we, by pursuing the same course, might not improve it. God intended us for progress, and we counteract his design when we deify antiquity, and bow down and worship an opinion, not because it is either wise or true, but merely because it is ancient."—*Francis Wayland, D.D., late President of Brown University.*

"We hear a great deal said of the intellectual treasures locked up in the languages of Greece and Rome, which it is asserted that our system of education throws open to the student freely to enjoy. And yet we know that practically this claim is without foundation. . . . For a period varying from seven to ten years, we keep young men under a course of instruction in Latin and Greek, and at the end of that time, they are unable, in any proper sense, to read either the one or the other. . . .

"We display a singular disregard of the plain indications of nature, who herself points out the order in which the faculties should be drawn out into action. . . . And I suppose that the reason why we should follow nature is because nature will thus most willingly follow us. The tasks we impose will be pleasing because they will be adapted to the strength. The learner will easily submit himself to our guidance, because we take him in the direction in which he is already inclined to go. . . . We have inverted the natural order just as completely as possible. And this inversion of the order of nature, carries with it

the unfortunate consequences that no satisfactory knowledge is acquired at last."—*F. A. P. Barnard, LL.D., President of Columbia College.*

"If there needs any further evidence of the rude, undeveloped character of our education, we have it in the fact that the comparative worths of different kinds of knowledge have been as yet scarcely even discussed—much less discussed in a methodic way with definite results. . . .

"We conclude, then, that for discipline, as well as for guidance, science is of chiefest value. In all its effects, learning the meanings of things, is better than learning the meanings of words. Whether for intellectual, moral, or religious training, the study of surrounding phenomena is immensely superior to the study of grammars and lexicons. Necessary and eternal as are its truths, all science concerns all mankind for all time. Equally at present, and in the remotest future, must it be of incalculable importance for the regulation of their conduct, that men should understand the science of life, physical, mental, and social; and that they should understand all other science as a key to the science of life. And yet the knowledge which is of such transcendent value is that which, in our age of boasted education, receives the least attention.

"Passing on to object-lessons, which manifestly form a natural continuation of this primary culture of the senses, it is to be remarked, that the system commonly pursued is wholly at variance with the method of nature. To tell a child this and to show

it the other, is not to teach it how to observe, but to make it a mere recipient of another's observations; a proceeding which weakens rather than strengthens its powers of self-instruction. . . .

"Object-lessons should not only be carried on after quite a different fashion from that commonly pursued, but should be extended to a range of things far wider, and continue to a period far later, than now. They should not be limited to the contents of the house; but should include those of the fields and the hedges, the quarry and the sea-shore. They should not cease with early childhood; but should be so kept up during youth as insensibly to merge into the investigations of the naturalist and the man of science. Here again we have but to follow nature's leadings. Where can be seen an intenser delight than that of children picking up new flowers and watching new insects, or hoarding pebbles and shells? And who is there but perceives that by sympathizing with them they may be led on to any extent of inquiry into the qualities and structure of these things? Every botanist who has had children with him in the woods and the lanes must have noticed how eagerly they joined in his pursuits, how keenly they searched out plants for him, how intently they watched whilst he examined them, how they overwhelmed him with questions. . . .

"It will by and by be found that a knowledge of the laws of life is more important than any other knowledge whatever—that the laws of life include not only all bodily and mental processes, but by im-

plication all the transactions of the house and street, all commerce, all politics, all morals—and that therefore without a due acquaintance with them neither personal nor social conduct can be rightly regulated. It will eventually be seen too, that the laws of life are essentially the same throughout the whole organic creation; and further, that they cannot be properly understood in their complex manifestations until they have been studied in their simpler ones. And when this is seen, it will be also seen that in aiding the child to acquire the out-of-door information for which it shows so great an avidity, and in encouraging the acquisition of such information throughout youth, we are simply inducing it to store up the raw material for future organization—the facts that will one day bring home to it with due force these great generalizations of science by which actions may be rightly guided."—*Herbert Spencer.*

"Infant and primary education I reckon the highest and most difficult of educational problems. . . . True education is an imitation, not a thwarting of nature. To be successful we must watch and learn how the Divine Goodness teaches the little Adam just entered upon his glorious heritage, we must conform to that method if we would be successful. And we find that God, in the infant's education, is no tyrant exacting of each his portion of loathed labor, but that he educates the expanding mind by freedom, joy and beauty, through nature training eye, and ear, and every sense, by every novelty of form, and sound, and color; and that we must help and not hinder

this natural education, by guiding, and controlling, and using the same materials.

"There is an intense and most easily awakened curiosity in children, respecting the phenomena of the outward world.—Every bird, beast and insect is a marvel; the clouds, the moon, the stars, the beautiful forms and colors of flowers, the very stones under their feet, all, to the mind of childhood are objects of study, objects of wonder. But after a few years of ordinary school-teaching, all this is found to have disappeared, and too often no other curiosity, no other interest, or worse still, some bad one, has arisen to take its place, I think I am not too strong in my statement; but what a satire is this on what we call education! Or is the process of teaching first to kill as a preliminary to artificially restoring them? Alas! in too many cases they are never restored, and our education consists only in a mental maiming. . . .

"So entangled are our notions of education with books and the art of reading—in reality only one of the tools of education—that we too often virtually use the tool, not to build, but to destroy our education. . . . The substitution of true object-teaching for an excess of book-learning in elementary education seems to me the first step in a return to truth and nature.

"Do you want to destroy a child's interest in a subject? Compel him to learn lessons out of a dry treatise upon it. Do you want to kindle his interest into enthusiasm? Give him oral lessons upon it—always provided you know how—which is, I grant, a

great assumption, because nothing is more difficult. For, first, you must know the subject. Now, if one would know how ignorant he is of a subject he thought he understood, let him try to give a child an explanation of it. One may lecture to grown persons, and succeed in concealing his ignorance from himself as well as his hearers; he cannot do so from a child. He will have nothing but real knowledge, and you cannot give it to him in any shape in which he can comprehend it without possessing it yourself. . . .

"Here is where, I confess, I think our teachers are too apt to come short of what ought to be required of them. I speak from personal experience as a teacher. Having learned from books themselves, they know only how to teach from books, unless, by putting themselves to school over again, they learn a better method.

"Shall I be thought very extravagant, if I say, so impressed am I with the necessity of a better selection of studies and better methods of teaching, that I am almost ready to affirm that the common school of America, as I believe it will exist in the future, is an institution yet to be created? . . . The common school is an institution not intended first and foremost to prepare a minority of pupils for higher seminaries of learning, and then devote what time can be spared to those whose education is to end with it. The district school should be, and can be, the people's college, though great changes must be made in it before it can become so.

"Life is education. Shall we send them from

school wanting the very rudiments of life-education? Above all, shall we leave them ignorant of the functions of the very bodies their spirits dwell in, and thus a prey, themselves, and their children, to all disasters which ignorance of the laws of life brings with it? I say that schools that neglect all this, are not good schools, and we cannot complain of the taxpayer grudging his money, when he finds his children learn so little that is useful."—*Professor W. P. Atkinson.*

W. L. WHITTEMORE.

March, 1869.

SECTION III.

NORMAL HIGH SCHOOL, 1870

CATALOGUE

AND

CIRCULAR

OF THE

NORMAL HIGH SCHOOL

MILFORD, N. H.

1867-70

MILFORD, N. H.
PRINTED BY J. M. BLANCHARD
1870

TEACHERS

Mr. WM. L. WHITTEMORE, Principal

TEACHERS OF MODEL CLASSES

Miss AMY LIZZIE SAWYER
Miss ANNA F. HUTCHINSON
Miss CARRIE A. DAVIS
Miss MABEL WEST
Miss ADDIE M. LAKIN
Miss LIZZIE E. BLOOD
Miss ELLA M. HUTCHINSON
Miss HELEN I. LANE
Miss ALICE J. HOOD
Miss LEVADE J. JOHNSON
Miss ANNAH E. ADAMS
Miss CLARA B. GUTTERSON

SCHOLAR ASSISTANTS

Mr. FRANK W. RICHARDSON
Mr. EMRI C. HUTCHINSON
Mr. CHARLES R. HOWARD
Mr. FRANK G. DICKEY

PUPILS

SENIOR CLASS

ADDIE M. LAKIN
MABEL WEST
CARRIE A. DAVIS
ANNA F. HUTCHINSON
AMY L. SAWYER
LIZZIE E. BLOOD
ANNAH E. ADAMS
CLEMMIE E. AVERILL
HELEN I. LANE
FANNIE E. LANE
LUELLA C. HUTCHINSON
CLARA B. GUTTERSON
FLORENCE M. LANE
EMMA A. PERKINS
EMMA BENNETT
ABBY P. PARMELEE
ELLA M. HUTCHINSON
LEVADE J. JOHNSON
CLARA E. CROSBY
ELLA M. TURNER

ELLA M. MARCY
FANNIE A. BULLARD
FRANK W. RICHARDSON
CHARLES R. HOWARD
EMRI C. HUTCHINSON
LUKE A. FARLEY
FRANK W. LOVEJOY
EDWARD G. CLARK
EDWARD G. CAME
HARRY C. LYNCH
FRANK G. DICKEY
GUSTAVE G. FLETCHER
GEORGE E. FARLEY
HERBERT L. PEABODY
ALLEN A. BENNETT
EDWARD T. ADAMS
GEORGE P. LYNCH
WALTER D. HUTCHINSON
CHARLES NEEDHAM
JOHN PEACOCK

JUNIOR CLASS

Hattie E. Farley	Oldis A. Barrett
Josephine E. Snow	William Peacock
Emma F. Wallingford	William A. Tarbell
Lucy J. Putnam	Elmon J. Gutterson
Lydia M. Darracott	Edward S. Kimball
Anna F. Bennett	Newell J. Sawyer
Georgianna Nutting	LeRoy S. Kimball
Jennie N. Clark	Fred W. Farnsworth
Dora E. Chickering	Aloft Johnson
Augusta J. Draper	Wendell P. Tarbell
Delia C. Hutchinson	Fred S. Hutchinson
Abbie Robb	Charles G. Hutchinson
Ella S. Burnham	George F. Burns
Susie E. Willoughby	Levi W. Perkins
Charlotte Gibson	Samuel Spalding
Nellie E. Danforth	Edward S. Howard
Cora J. Lynch	George E. Sheldon
Augusta C. Mixer	Lauren M. Follansbee
Hannah Dempsey	Charles W. Miller
Florence H. Lund	Charles E. Wilkins

ELEMENTARY CLASS

Hattie P. Mixer	Charles E. Crosby
Nellie C. Turner	William Wadleigh
Mary J. Richards	Richard Burns
Eunice Bacon	Walter M. Lynch
Ella A. Dewitt	Charles I. Wilkins
Ella Willoughby	Philip H. Osgood
Eunice Huntress	Timothy Crowhan
Ella M. Brown	George Shanessy
Fannie Percival	Henry W. Brown
Carrie Dean	Horace Dean
Anna Shanessy	Charles French
Minnie Barrett	John Barrey
Eunice Robinson	John Gourley

FIRST MODEL CLASS

Clara J. Towne	Florence S. Coburn
Kate A. Dickey	Emma S. Powers

SECOND MODEL CLASS

Nellie E. Hutchinson	James Melzer
Belle B. Hutchinson	George Bass
Belle Knowlton	Aura Bowen

THIRD MODEL CLASS

Frank Wilkins	Hattie Woods
Fred Wilkins	Fred Holmes
Willie Trow	George Trow
Willie Guild	Walter Mills
Eddie Duncklee	Clinton Masseck

FOURTH MODEL CLASS

Charles Johnson	Grace Coburn
Freddie Howard	Fred Wetherbee
Estella Woodbridge	Arthur Wallingford
Philena Woodbridge	Charles Trow
Hattie Hall	Frank Dean
Etta French	Walter Dean
Anna Steele	George Johnson
Samuel French	Maggie Barrey
Charles Mackay	David Barrey
Etta May	Julian Tarbell

SUMMARY

Number of Pupils	146
" " Girls	73
" " Boys	73
" in Senior Class	40
" " Junior Class	40
" " Elementary Class	26
" " Model Classes	40
" " Common Branches	140
" " Algebra	36
" " Geometry	34
" " Trigonometry	11
" " Book-Keeping	10
" " Natural Philosophy	40
" " Botany	64
" " Geology	47
" " Chemistry	41
" " Physical Geography	36
" " Physiology	32
" " Astronomy	32
" " Zoology	40
" " History	44
" " Rhetoric	18
" " Greek	18
" " Latin	18
" " French	15
" " Mental Philosophy	12
" " Political Economy	12
" " Logic	10

GRADUATES

CLASS OF 1865

FRANCES S. PERRY
HELEN I. LANE
CHARLOTTE S. ROBBINS
*ANTOINETTE A. PILLSBURY

CLASS OF 1867

FANNIE E. LANE
ALICE J. HOOD
JOSEPHINE E. BRUCE
ISADORE J. RICHARDSON

CLASS OF 1869

LUELLA C. HUTCHINSON
FLORA J. CUTTER
ANNAH E. ADAMS

CLASS OF 1870

CARRIE A. DAVIS
AMY LIZZIE SAWYER
ANNA F. HUTCHINSON
MABEL WEST
ADDIE M. LAKIN
LIZZIE E. BLOOD
FRANK W. RICHARDSON
EMRI C. HUTCHINSON
CHARLES R. HOWARD

*Deceased

CIRCULAR

What shall we teach? And how shall we teach? These are the great educational questions of the present century; but during the last few years much progress has been made towards a philosophic and satisfactory answer. The main question to-day seems to be a question of method; for if the innate energies and activities of the child can be rightly directed, not only all the sciences which constitute the real knowledge of the nineteenth century may be well learned, but much may be accomplished in our common schools in such arts as may have the most direct bearing upon human welfare.

It has been said and often repeated that "there is no royal road to learning." But is it possible that a scheme of culture, empirically adopted in the dark ages, is never to be superseded by a better one? Human devices are not born perfect; but they tend towards perfection by natural growth. The earth through cycles of ages, passed from a fiery chaos, first to an abode for hideous monsters, and then to a paradise for man. Simple organisms soon reach maturity, but complicated ones require centuries. The law is the same with the devices of men. The puerile nonsense of astrology grew through successive

ages into the sublime science of astronomy. The alchemists, covered with the thick mist of ignorance, labored under a strange delusion for centuries; but their diligent search for power to change base metals to gold and mortality to immortality, led them to the very portals of the inner temple of Deity, and disclosed the hidden springs of nature's million laboratories.

There is no reason to think that the management of the most complex affairs of society will ever cease to be improved; for the knowledge of truth is progressive, and every new fact that is discovered may influence our course of action. We are not to blame the past because all its wisdom is not adapted to the wants of the present time; much of the wisdom which blesses the world to-day may become obsolete as the centuries roll by.

The method of education that prevails in this country, and which must prevail until a better one shall have been more generally learned, spends its energies on the mere trappings and appliances of true education, and dealing with these in a manner opposed to the law of mental acquisition, accomplishes comparatively little even in what it undertakes. We are beginning to understand that to depart from Nature's fixed laws is, and must be sure defeat, whether those laws relate to matter or to mind; and

that to ensure obedience to laws it is extremely necessary to know of their existence.

True education is the greatest of all arts, and is founded on the deepest of all sciences: on these sciences it depends for direction in all its processes. The objective universe is marvellous indeed; but how much more so is the mind that is to comprehend it. To educate that mind properly, is the most complex, as well as the most essential work that mortals have to do. A system of culture that involves no special knowledge of the being to be educated and no professional training for the work, must not only be futile in its efforts to educate, but a flagrant outrage upon the mind of its recipients.

Educational philosophy dictates an entire revision of the present mode of culture. Directing us to the primary source of all knowledge, and to its acquisition in Nature's own method, with all the aid that science and art can furnish, it prepares the way for rapid progress in every science. Captivated by a succession of new ideas as he is led on by systematic observation, the child soon begins to analyze and interpret the phenomena of Nature, and to perceive the beauty and the harmony that pervade the world. In the volume of Nature there are no faults. It is God's perfect text-book for the young and the old of all nations and for all time. Its ample pages are all

illuminated with infinite skill, to allure us to the study of the perfect wisdom of the great Author of all.

The deep defects of the predominant culture are everywhere apparent. Reversing the order of Nature, it violates the laws of development in almost all its processes. Vicious alike in its methods and its tendencies, it crushes out the natural love of knowledge, produces intellectual stagnation, petrifies the heart, and signally fails to accomplish the high purposes which a true culture must accomplish.

Possessed of faculties susceptible of endless expansion, and fitted by Nature to study her works and learn her mysteries with wonder and delight, the child of five years enters school with faculties all alive to the marvels that surround him. He has already learned intuitively the most obvious properties and simple relations of every familiar object; and through his constant voluntary efforts to express the ideas which have entered his mind through these objects and their attendant phenomena, he has, since the age of about two years, learned the mystery of language. Moreover, the ability to talk is the least of the child's acquisitions before entering school. The knowledge of things around him — the things with which he is to deal as long as he lives, is the great acquisition.

The first five years of school life are the all-impor-

tant years of the scholastic course: yet the teacher accomplishes very little except to stultify the quick perceptions of childhood. The reason is obvious. He begins by the contravention of Nature's law, superimposes arbitrary and unnatural work, and fails to perceive that he is to aid that spontaneous education which has already accomplished so much. Those wonderful intuitive attainments, without which the child would require protection every moment, are all overlooked or counted as nothing. The observing faculties, those natural avenues of knowledge, without which all education would be an impossibility, are suppressed or practically ignored; and the child is treated as if the only road to learning were through the arbitrary signs of ideas — as if the knowledge of things were nothing, but the knowledge of words the great desideratum.

We might as well expect an ample harvest from sowing in the eternal snows of the Himalaya, as to expect much real culture in our primary schools as now organized. And the time has now come when this inappropriate and profitless course, long sustained by the power of old tradition, must gradually give way for a more philosophic and natural one. Efforts to improve our schools of higher grade will be of little avail until the method in our primary

schools is radically changed. We are not to modify an old method, but to inaugurate a new system.

But has the missing truth been found so that a faultless scheme can at once be adopted? No science is yet perfect. The finite cannot comprehend infinite. The general laws of astronomy are known, and an eclipse is foretold centuries before it takes place. So in the science of education the general principles are established, and by their guidance we can make rapid progress towards a perfect system of culture.

A right mode of teaching coincides with nature's tendencies, and instead of repressing, guides the natural activity of the mind in accordance with the laws of its spontaneous evolution, utilizing the child's playful activity for available culture.

Science is the great revolutionary power,—the pioneer of every true reform. What hidden stores of wisdom she has brought to light, and what mighty conquests over nature's forces she has won! During the last half century she has revolutionized almost every art, and given us all the varied blessings of the present hour. Science now begins to direct the hand of human culture, and will save our race from the evils of violated law by saving us from ignorance. Empiricism can no longer be trusted to direct the energies and aspirations of the mind; and instead of frowning upon a rising science, let us hail

with transport every new light that can aid us to comprehend the realm of universal law in which we dwell.

At this stage of the world's progress, when nations are awakening to the right of the majority to rule, it is essential both to social and civil prosperity, that every one be so educated as to see that he is not at liberty to hold to such opinions as his preoccupied imagination may fancy, but that he has no right to an opinion until he possesses facts, and draws conclusions from evidence. Great truths have been smothered for ages after they were first announced, and their discoverers persecuted instead of cherished for their manly defence of them, because an unreasoning populace were unable to separate truth from prejudice. If we would but learn the laws of the world's progress in science and in civilization, we might be saved from such self-defeat, and at the same time both gain and give the pleasure of a grateful recognition of the self-sacrificing spirit of the benefactors of our race.

In one of the Nashua papers of January, may be found the following, from the pen of a Milford correspondent:

"Last Tuesday evening Professor Sanborn of Dartmouth College favored us with the most sensible lecture ever delivered in this town on the subject of

education. . . . He alluded also to the folly of introducing into our schools object-teaching. . . . The lecture of the Professor will be the means of doing good, and he deserves the thanks of the whole community for daring to take such a manly stand against a great and growing evil."

The few assertions made by Professor Sanborn are not quite sufficient to convince all who listened of the correctness of his views. He stated that object teaching is one of the innovations of the day; that it comes from the West, and captivates such teachers as cannot discriminate between innovation and progress. He compared the interest in object teaching to the velocipede mania of last year, stating that it would last about as long and do about as much good.

He ridiculed the idea of strolling about for flowers, butterflies and everything else for object lessons, and enquired when the children would learn to read and spell, if time is taken for such work.

This is the substance of his remarks on that topic. It was not necessary to say any more. He succeeded well in showing that he knows very little of the subject, that he neither understands the methods, nor comprehends the philosophy of such instruction; and instead of "deserving the thanks of the whole community," it seems to me that he deserves the public censure for undertaking to enlighten the community

on the subject, while he is so ignorant of the first principles of primary instruction. Neither the lecturer nor his reporter ever saw one of the object lessons which they labor to suppress, and hence their opinion of them is worth no more than that of a Hindoo upon the origin of the Shasters.

Here we see a single instance among thousands that daily occur, of the sad result of that fatal error in the education of our time, which, by ignoring the sciences that train the mind to logical reasoning, gives the educated man but little advantage in reasoning over the uninstructed. The education that does not inculcate humility and reservation of judgment must be faulty indeed. Mere linguists or mathematicians as well as the untaught, oftentimes find no difficulty in forming an opinion before they have learned the first fact on the subject; and the unscientific pronounce upon scientific questions with all the assertion and audacity of the old astrologers.

"If we consult reason, and the common testimony of ancient and modern times, none of our intellectual studies tend to cultivate a smaller number of the faculties, in a more partial or feeble manner, than mathematics. This is acknowledged by every writer on education of the least pretention to judgment and experience." *Sir William Hamilton.*

"There is no study that could prove more success

ful in producing often thorough idleness and vacancy of mind, parrot-like repetition and sing-song knowledge, to the abeyance and destruction of the intellectual powers, as well as to the loss and paralysis of the outward senses, than our traditional study and idolatry of language."

Professor Halford Vaughan.

"Persons who have been fully educated, according to the present system, come to me with the same propositions as the untaught and stronger ones, because they have a strong conviction that they are right. They are ignorant of their ignorance at the end of all that education. . . . Until they know what are the laws of nature, they cannot clear their minds of these, as I say, most absurd inconsistencies; and I say again, that the system of education that could leave the mental condition of the public body in the state in which this subject has found it, must have been greatly deficient in some very important principle." *Professor Faraday.*

"The models of the art of estimating evidence are furnished by science; the rules are suggested by science; and the study of science is the most fundamental portion of the practice; . . . All men do not affect to be reasoners, but all profess, and really attempt, to draw inferences from experience; yet hardly any one, who has not been a student of the physical sciences, sets out with any just idea of what the process of interpreting experience really is."

Mr. John Stuart Mill.

Object teaching does not come from the "West," —it comes from the opposite direction,—from learned Germany, and dates from the time of Pestalozzi, the discoverer of most of its principles. From the beginning of the present century it has been extending in all directions from Germany. The application of its principles has been greatly extended in Europe during the last thirty years by Froebel, Baroness Marenholtz-Bulow, and others.

Its progress in America has been greatly hindered, both by the lack of scientific culture on the part of most teachers who have attempted it, and the neglect of serving an apprenticeship in the application of the principles. Americans are much inclined to think that nothing is too difficult for them to do, whether they have learned to do it or not; and those who attempt this most difficult work without due qualification, not only accomplish very little good, but bring the system into disrepute by their want of skill in its practice. This is probably what has turned Professor Sanborn's face from it; but it seems that he was not so deeply impressed with "the folly of object teaching" as to think it best to present his views in other places where he lectured. I am unable to hear of any other place where he mentions the subject at all. Yet I may be misinformed. Can it

be possible that he thought Milford alone was unable to take care of her own interests?

The general system to which I have given my mind for nearly eighteen years, and which we have gradually adopted in Milford, as far as circumstances would allow, is the only professional or studied system in the world. To be carried on successfully it involves much knowledge of all the things with which the teacher deals, including all the sciences to be learned, and the being that is to learn them. Hence it will be seen that its methods cannot be caught up and put into practice by any one, at pleasure, but that they must first be learned. This cannot be done in a day nor a year; the whole scholastic course is the appropriate time, and is none too long; for it involves all that knowledge which constitutes the best general education for all places and circumstances in life.

By object lessons we mean the learning of science by actual inspection of the object of study, instead of learning a written description or listening to oral description. It requires very little penetration to see which is the best method. Can we make botanists without plants, astronomers without stars, mineralogists without minerals and philosophers without seeing the objects and phenomena of the world? The

best description that can be made conveys to the mind but a dim shadow of the reality.

Can we describe the face of our most intimate associate so that a stranger would recognize him in Broadway to-morrow? Do we know how Vesuvius appeared to an observer after learning his description? The object method is nature's method. Can the rainbow be described so that a blind man who has never received one of nature's object lessons on colors can gain any correct idea of its splendor? He can gain no idea of the meaning of words expressive of color, because object lessons on color are an impossibility with him.

It is strange "folly" that would close the natural inlets of knowledge—the senses, and refuse to teach the child anything of the world we inhabit, until an artificial method can be created. The artificial method is never to be used as a substitute for the natural one, but is to be employed to gain what knowledge we can of inaccessible things, and of abstractions.

Any intelligent person who knows what object teaching is, can as readily see the superiority of that method over all others as he can see the superiority of the sun, for illuminating purposes, over the pine knots and candles of the last generation. The boy that thought the map was the reality, and stated that

"North America is about seven inches long," and that the "meridians are lines crossing the equator at right *angels*," was greatly in need of a few object lessons in geography as well as upon angles.

Of course it is not necessary to always have the object present. After we have once seen the rainbow, observed with care all the facts relating to it, impressed upon the memory its blended colors, and the order of their arrangement, noted all its aspects, measured the height of its arch, and its angles with the sun, we may then discourse upon it, and study the philosophy of its formation at pleasure.

We have classes from seven to twelve years of age in botany, mineralogy, chemistry and most other sciences, and their interest and progress equal that of the older classes who use books. In botany the scholar learns the number, form, size and color of petals, stamens, leaves and all other parts by personal observation. He is told only such things as he cannot discover, such as names of parts and properties, and some of the uses of the plant. In entomology he inspects the insect; in mineralogy the specimen of ore, metal or other mineral is present; in chemistry he sees the invisible element separated from its compound, and with taper in hand he has gained a new sense.

Oral expression immediately follows observation:

and how eager the child is to tell what he has learned. Next is the mathematical investigation of the object, including concrete geometry, drawing and arithmetical problems. Very young children are interested in making mathematical discoveries and computations, and at the same time they are indelibly fixing the scientific facts in the memory. Last of all follows the reproduction in written language of all that has been learned upon the object. Of this the child never tires, but he acquires descriptive power seldom equaled by scholars twice as old, who are trained in the common method.

"But when will the children learn to read and spell?"

By the object-method the child will not only read and spell better at the age of eight or ten years, but he will accomplish twice as much in writing, composition, and mathematics as in any other, and all these branches are learned incidentally, while the main work is the pursuit of science. There is no delay in the acquisition of knowledge if we first give the child a motive for learning, and then present the work in the natural order.

The above statement may be considered extravagant, but we solicit careful investigation. Moreover, there are parallels in nature, which if we would study, we need not be surprised.

Mark the course of the young child under nature's tuition. His first words are names of things of essential interest to him. Those words never could have been learned if his senses had not taken cognizance of the things, and conveyed an idea to his mind. The observation of the thing gives rise to the idea, and the word is the expression of the idea. The word, then, is virtually created by the thing, and from it derives its meaning and all its interest.

In testing a child of two years we found that in a single day she used over a hundred different words. About three fourths of the words were names of things she often saw; and every thought she expressed was suggested by those things. Another test was with a boy of five years. He could talk with equal fluency in two languages; but had never been taught in either. He learned one in the family, the other in the street. Is there any such progress as this in our own or any other language in our schools? If we would have the child continue to learn language in school as he does before he enters, we must adopt nature's method, and furnish him with new ideas by daily presenting new objects and phenomena. Things before words is clearly the natural order with early childhood; is the law reversed the moment he enters school?

But a clear idea of the object-method cannot be

given by words. One who wishes to know how the work is conducted must necessarily have an object-lesson on object-teaching. Our rooms will be open to visitors for a few weeks, beginning about the tenth of May, and all are invited to spend a day or two with us.

It is scarcely necessary to say a word in this community upon the merits of the normal system of instruction. Notwithstanding every circumstance has been unfavorable, except the system itself, the success of this institution from the day it was opened has exceeded the expectations of its most sanguine friends. Our rooms have always been filled beyond their capacity to accommodate; and our number has included the greater part of the advanced scholars of this village and vicinity.

The influence of the normal system in Milford, for the past fifteen years, seems to have been beneficial. It has qualified a large number of young ladies for the profession of teaching; and, judging from the demand for their services, and the wages paid them, it would seem that their teaching is valued. The average wages of female teachers, in this State, last year, was less than twenty-one dollars. The average wages of our graduates was forty-two dollars,—nearly as much as that of the graduates of the Normal University of Illinois, which was forty-six dollars. It

also seems to have raised the public estimation of the value of good learning. Our district, for the last year, has paid twice as much per scholar, for instruction, as was paid five years ago, and more than twice as much as the average in the State. Besides, very liberal donations of piano, carpets, paintings, statuary and other ornaments for the school-rooms, have been made by citizens, to supply the place of those previously furnished gratuitously, by teachers.

It is thought that chemical and philosophical apparatus, cabinets of minerals, and other specimens for illustration of natural history will soon be purchased so that the sciences of nature, which, if rightly taught, constitute the central star in education, may be taught in our public schools. I have such articles, sufficient to illustrate most facts of science, including many valuable reference books and charts, which I have used during my teaching in Milford, and I hereby offer the district the free use of them, such as they are, during my absence in foreign countries.

The natural sciences all culminate in the science of human nature; and are to be learned as a key to that highest order of truth—the laws of the human mind. Knowledge of moral law is the highest knowledge within the reach of man. Its real possession constitutes the highest order of greatness. Galileo and Newton possessed almost intuitive mathematical

greatness. Socrates and Confucius possessed moral greatness. Both these orders of greatness depend alike on culture. The one penetrates the regions of immensity and measures the stars in their course. The other seeks to know the right, and having found it, never quails in its defence, but stands by it, with a sublimity of purpose that defies all danger,—stands by it as the mountain stands when the storm rages around its unshaken summit.

The works of the great Architect, whether material or immaterial, are all radiant with His thoughts; and when, through the ennobling tendency of their study, we have reached that transcendent order of truth to which all other truth is accessory, society will be on the highway to social and political prosperity.

WM. L. WHITTEMORE.

MILFORD, April, 1870

SECTION IV.

MILFORD PUBLIC SCHOOLS, 1875

REPORT

OF THE

BOARD OF EDUCATION

OF MILFORD, N. H.

FOR THE YEAR 1874-5

A very wise man of ancient time has said that there is but one good in the world, and but one evil,—that knowledge is the one good, and ignorance the one evil. This exalted estimate of the value of knowledge is becoming more and more general in all civilized countries.

Our common schools are the repositories of knowledge for the people, and should be guarded with special care and unceasing vigilance. A well reguated school system is an essential element of a people's prosperity; for knowledge is the foundation and support of our liberties.

PRIMARY SCHOOLS

The importance of these schools and the difficulty in properly teaching and managing them is not, we fear, sufficiently appreciated. They are the foundation of our educational system, and unless this is firmly and securely laid the whole structure will prove a failure. We have been remarkably fortunate the past year in having teachers of great merit in these responsible places.

First Primary.—This school has been under the charge of Miss Clara E. Crosby during the entire year. Good order has been maintained, and very commendable progress made in all the studies. Through the energy and tact of the teacher, each term has been an improvement over the preceding.

Second Primary.—This school presents a model of excellent order, and energetic and spirited teaching, joined with activity, lively interest and perfect obedience on the part of the scholars. Miss Alice C. Gray, teacher.

Third Primary.—It was found, at the beginning of the year, that there were more young children about to enter school in the village, than could be accommodated in the second primary; consequently, suitable rooms were secured, and a third primary school was opened, under the instruction of several young ladies of the high school, each teaching one hour a day, and having no other compensation than a course of instruction upon the most approved methods of primary education. The first class was taught by Mary E. Coburn and Helen L. Buttrick, the second by Hattie J. Burdick and Kate A. Dickey, and the third by Sarah W. Bruce and Clara J. Towne. No scholars in town of similar age have made better progress than these. The teachers have manifested a lively interest in their work, and are entitled to much credit for their successful efforts.

West Primary. — Spring term. Miss Annah E. Adams, teacher. By earnest and faithful effort, Miss Adams brought this school to a high degree of excellence; but unfortunately, her health failed toward the close of the summer term, and being unable to resume her work in autumn, she was succeeded by Miss Mary A. Hartshorn, who has taught the last two terms with marked ability and great success.

GRAMMAR SCHOOLS

For many years past there have been two agencies, constantly tending to make the grammar schools difficult to manage and unsatisfactory in their results. One reason why these schools have been so generally found in a demoralized condition may be looked for in the frequent change of teachers. Very few teachers have remained in these schools long enough to eradicate the existing bad habits they found on entering them.

A second hindrance to success in these schools may be found in our defective system of teaching, which here begins to manifest its mischievous tendencies too forcibly to be easily mistaken. Young children are naturally eager for knowledge; and when we give them real knowledge, such as they can assimilate and organize for use, instead of unmeaning words and processes, their love of study deepens with age. But under existing methods, the love of knowledge is often crushed out before the child reaches the age of ten years, and he takes no interest in anything connected with school, except the society of his mates, and the various amusements they manage to introduce to break up the monotony of school work.

East Grammar.—The spring term was taught by Miss H. Juliette Gilson, a teacher of great energy and superior ability. Much was done to break up the ordinary routine, and to cultivate a love of general intelligence, by spirited conversations upon science, art, and passing events.

The fall and winter terms were taught by Miss Isadore Richardson, who has labored with great perseverance and with success. Since the middle of the fall term the school has steadily improved. There has been a marked change in the habits of the scholars, both in respect to deportment and attention to study.

West Grammar. — Teacher, spring and winter terms, Miss Charlotte S. Robbins; fall term, Miss Luella C. Hutchinson. Through the well-directed efforts of both teachers this school closes the year in fine condition, although it was badly demoralized at the beginning. The scholars are cheerful and happy, and appear to enjoy school better than ever before.

HIGH SCHOOL

Principal, Mr. G. B. French, spring term. At the end of the spring term, Mr. French closed his connection with the high school, having served faithfully for two years, and given very general satisfaction. He was assisted by Miss Ellen W. Beane, of Norton, a very intelligent and accomplished lady, whose services were highly appreciated.

Mr. French was succeeded by Mr. S. J. Blanpied, who has had charge of the school since the beginning of the fall term. Mr. Blanpied is a teacher of thorough culture and considerable experience. Under his judicious management the school has gradually improved, and has accomplished all that could be reasonably expected.

GENERAL REMARKS

There has been a growing conviction on the part of many of our citizens, that the high school for several years past has been managed upon a plan hardly in harmony with the principles of economy, and equal rights.

It is alleged, first, that the study of the dead languages has been held up as the one essential thing in education, and that the best efforts of teachers,

and of a small number of scholars have been given to that work, while all branches of English education have been slighted, and looked down upon with a feeling bordering upon contempt, thus spoiling the education of ninety-nine scholars who must complete their studies here because, possibly, the one hundredth may wish to go to college.

Second, it is alleged that this policy is not only ruinous to the interests of the high school, but is beginning to react upon the lower grades, as it fails to furnish teachers suitably qualified to teach the common branches of English education; and third, that this policy is not only fatal to the interests of true education, but annually wastes a large amount of the public money.

In reply to such charges as these, the board feel called upon to state such facts as have come under their observation, and then leave the subject for others to dispose of as they will.

It should be borne in mind that in all small places like Milford, the standard for admission to the high school must necessarily be much lower than in towns many times larger. In a town like this about one tenth of the scholars must be in the high school, without much regard to age or scholarship. In large cities not more than one in fifty, or even one in a hundred is in the high school. Hence such scholars

as the two younger classes, always numbering more than one-half of our school, would be found in the grammar schools of all large places. In the classification of the high school this fact has hardly been recognized; consequently much elementary work, which is of first importance in education, has been left undone, and scholars have worked at great disadvantage in the higher branches. In the written examination of the school last June, the higher classes were found more thorough in arithmetic than in any other branch of English education. Seven of the nine graduates failed in the following example: "What is the value of five acres of land at three cents per foot?" In the next example four failed: "What is the amount of $400. for three years six months at seven and three tenths per cent. simple interest?"

The sixty per cent. of failures did not arise from slight mistakes, but from failing to find the proper method of solution.

This is a specimen of the best work presented while the poorest work was in the understanding and use of our own excellent language—a language which, in the opinion of foreign scholars, is hereafter to gain the sovereignty of the world.

During the spring term the time of two teachers was divided between the different branches of study

as follows: Sixty per cent. to instruction in languages, including our own language; twenty-five per cent. to mathematics; fifteen per cent. to science. There were five classes in foreign languages. The classification and division of time is about the same as it has been for several years past. It clearly indicates a one-sided culture, which was fully substantiated by the examination. A symmetrical culture would be more favored by a division more nearly like the following: Thirty per cent. of the time for mathematics; Thirty per cent. for science; thirty per cent. for language; ten per cent. for art.

At the present time we have nine scholars in languages, and three classes for their accommodation. There was some pressure last term for the formation of two more classes for the accommodation of three other scholars.

A false classification has been one of the chief agencies in bringing the school into its present condition. It has been divided and subdivided into nearly three times as many classes as there ought to be. With two teachers the scholars have been under instruction only about one-fourth of the day, while with one teacher and a proper classification each scholar would be under instruction considerably more than one-third of the day. By this means much more thorough work would be accomplished, not only in

mathematics, science and the languages, but there would be time to spare for drawing, writing and other general work.

North School.—This school was taught by Miss E. Jennie Fifield until the close of the fall term, when she retired, highly esteemed both by scholars and parents. Under Miss Fifield's steady and careful instruction for four consecutive terms the school reached a high degree of excellence.

Miss Fifield was succeeded in the winter term by Miss Annah E. Adams, who fully maintained her reputation as a good disciplinarian and excellent teacher.

Pine Valley School.—This school has been fortunate in retaining through the year the services of Mrs. Harriet L. Cleaves, an experienced and reliable teacher, remarkably well adapted to the important place she occupies. We hope she may be retained for terms to come.

Howard School.—Miss Fannie Bullard, teacher. This school always appears well and is one of the best in town. The teacher is active and energetic; the scholars, studious and cheerful. Under these conditions progress is always certain.

Shedd School.—Spring term. This school was ably taught by Miss Mary A. Hartshorn who resigned at the close of the spring term. Miss Anna L. Colburn, a recent graduate of the high school, succeeded her. Being unskilled both in the theory and practice of teaching, Miss Colburn was hardly able at first to meet the demands of her new employment; but the experience of the first few weeks, joined with energy and good judgment, enabled her to bring the school into very fair condition before the close of her first term.

Osgood School.—This school has been favored by the instruction of Miss Catherine A. Tuttle through the entire year. Miss Tuttle is a fine scholar and a careful and thorough teacher. Under her superior instruction the school has done remarkably well.

Abbott School.—The spring term was taught by Miss Emma Bennett; but, unfortunately for the school, her valuable services could be retained no longer. The instruction was spirited and thorough, and the progress of the scholars highly satisfactory. Miss Bennett was followed by Miss E. A. Thomas of Hudson, who kept the fall term with fair success, and by Miss Laura A. Tilton, whose first efforts at

teaching during the last term have been very satisfactory.

Duncklee Hill School.—Miss Ermina E. Holt still gives her best endeavors to this school. The scholars have been kept close to their studies and to the rules. Miss Holt has great skill in ensuring diligence, good behavior and love of study.

It may be seen by the foregoing brief remarks upon the different schools, that they have been, generally, prosperous through the year. In two or three instances the obstacles in the way of success were greater than the teacher was able, at once, to remove; but during the winter term every school has been in very fair condition.

The perfect teacher has not yet made his appearance in the world, but it is not wise to emblazon every fault,—a few deserve mention.

Manner. Teachers should be spirited, lively, energetic, and refined in their manner, brief, direct, clear and impressive in all they say, both in teaching and governing, but never noisy and blustering.

Pronunciation. Closely allied to a faulty utterance in several of our schools, is a false pronunciation of words. We raise no issue with the disciples of Worcester or Webster, but do protest against the prevalent violations of both taste and all dictionaries.

We insist that together is never togather; that often has no *t* in its pronunciation; that *a* in half and laugh is never correctly pronounced as *a* in man.

Ventilation. Many of the school rooms are often too warm or else cold—not ventilated at all or else carelessly ventilated, endangering the health of scholars from colds or from poisonous gases. By careful study and constant attention, the teacher could often make the scholars more comfortable, and thereby secure better order and attention to study.

MODERN CULTURE

In all we have said of our schools thus far, our standpoint has been the traditional system of education, which had its origin centuries ago, when modern civilization was in its infancy — a system which has been long sustained in this country by the power of old tradition and by blind habit, notwithstanding its want of adaptation to the present time. From this point of view we may speak of our schools in terms of commendation; but when we view them in the light of modern educational science, and compare them with what we ought to have and might have, the comparison at once becomes a contrast.

It is neither longer schools nor more money to expend on them that we stand in greatest need of,

but the overshadowing and pressing necessity is the introduction and use of the educational ideas of the nineteenth century.

We are clinging with extreme tenacity, to a system of education which was better suited to the wants of earlier times, but is out of harmony with the intellectual necessities of modern life; a system which idolizes the past and worships precedent and authority. Progress consists not in rejecting the past, but in assimilating and reorganizing its truth into harmony with new circumstances and new requirements.

The deep defects of the predominant culture are everywhere apparent. It violates the laws of development in almost all its processes. Vicious alike in its methods and its tendencies, it crushes out the natural love of knowledge, and signally fails to accomplish the high purposes which a true culture must accomplish. We must extend the knowledge of our predecessors and correct their errors. Our errors will be corrected by our successors. Obedience to obsolete forms must no longer be held forth as a virtue, for the knowledge of truth is progressive.

Civilization has its inflexible laws. Institutions are not born perfect and adapted, without change, to all time and all circumstances. The history of all civilizations plainly shows that perpetual stagnation is the fatal consequence of extreme conservatism.

Within the memory of some of our citizens we have given up many of the methods of our ancestors. Old ways are tedious and too expensive. We no longer occupy the stage-coach for the better part of a week, when we have a few hours' business to transact fifty or a hundred miles away. A modern idea, expressed in the locomotive, saves us one-half the fare and two or three days' time, to say nothing of personal comfort.

We can hardly realize the magnitude and importance of modern discoveries and inventions. Almost every art has been transformed within the last forty years, and our manufacturers and business men would become bankrupt if they should ignore modern ideas and methods in their business as they are ignored in education.

We have made wonderful progress in material prosperity, but very little improvement in the means we employ for our emancipation from the thraldom of ignorance and immorality. You saw quite as good instruction in the old brick house by the bridge twenty-five years ago, as we have seen in most of our schools the past few years. We have better schoolhouses, more studies and longer schools, but the same primitive method of teaching.

Educators from foreign countries have justly criticised our school polity, as lavishing money upon

school buildings, furniture and fixtures, while we regard the qualifications of teachers as of secondary importance.

The discoveries of modern science have given us the telegraph, railroads and steam-boats, and brought to our doors all the products of nature and of art. Yet there has been no greater progress in the sciences which underlie industrial prosperity, than in those which unfold the laws of mental culture. In one case science has been utilized, in the other ignored.

When a steamship is to be built, all the knowledge in the world, upon the application of steam power and ship building, is brought to bear upon the enterprise. The same is true in many of the arts and manufactures; but how different it is in education!

On completing his general education the candidate for either of the learned professions must spend years in learning the special knowledge of the profession he would enter. The merchant goes to the mercantile college and the mechanic to his apprenticeship; but the teacher, whose work is the most complex and difficult that mortals have to do, goes at once into practice, although as ignorant of the laws of mental development as the children he undertakes to teach.

That such is the status of education is not the fault of teachers, but of public sentiment. Very few

have investigated the subject far enough to know that there is any science of education, except what anyone may know intuitively. Yet in some parts of the old world teaching has recently become a learned profession, and the most learned of all professions, requiring six years of special study and training.

Most men hate new ideas. What has been the history of the introduction of every modern improvement which blesses the world today? How did the public behave towards Fulton when he declared that steam power would some day propel ships across the Atlantic? towards Stephenson, when he announced his plan for moving a train of cars by steam twenty miles an hour? towards Field, when he thought a message could be sent across the ocean with lightning speed? Each of these great benefactors was ridiculed and accused of foolishness or insanity; yet we have already realized even more than they promised.

If the building of the first steamer had depended upon the vote of the majority, when would it have been built? Private fortunes were expended before the public had any faith in its practicability or in its possibility. But when the boat was seen to move, and the "rattling car" was heard, when telegrams from central Europe told us of battles before the "cannon's roar" had ceased, men were compelled to believe.

If we would but learn the laws of the world's progress in civilization, and qualify ourselves to distinguish between truth and error, we might save ourselves from that self-defeat which marks, not only the present, but all past ages. Great truths have been smothered for centuries after they were first announced, and their discoverers persecuted instead of cherished for their manly defence of them. Bruno, the Italian astronomer, was chased through France, England, Germany and Switzerland, for teaching that the sun and some of the planets are as large as the earth. At last he was arrested, taken to Rome, and burnt at the stake in the year 1600. Galileo would have met the same fate for teaching that the earth revolves around the sun, had he not, on his knees, retracted all he had taught, and promised to desist from farther teaching. Sixteen years later he published a book on the motions, size and distances of the heavenly bodies, and was again seized and compelled to abjure the doctrine it taught as false and pernicious. He was then cast into prison, where he died after ten years of most cruel treatment, and he was denied a decent burial. Thus perished the most illustrious and devoted scholar of the age, because his teaching was not in harmony with existing traditional authority. These illustrations show the atti-

tude of European civilization toward science at the beginning of the seventeenth century.

In still earlier times scientific men did not dare to teach publicly at all; but at the close of life left the result of their study in writing, as a legacy to the world, when they had passed beyond the reach of its cruelty.

In every age of the world's history, millions upon millions of human beings have perished from lack of knowledge; yet, in every age, knowledge has been met as an intruder in the world. Had the spirit of toleration which is now, slowly, but surely gaining a place in modern society, ruled in ages past, instead of the intolerance which has so hindered the increase and diffusion of knowledge, might not the light which once shone in Alexandria, the birth-place of real science and scientific methods—might not the wisdom of Eratosthenes, Hipparchus, Hero, Euclid and a hundred other immortal names which there found a place under the fostering care of the illustrious Ptolemies, have come down the centuries with increasing power, to illuminate the long night of ignorance through which the world has passed?

The mission of science is just begun. It has had but here and there a solitary disciple; yet it has helped us much in our remote interests. Our immediate and greatest interests can be regulated only

through the personal possession of scientific knowledge. Among those who have been thoroughly and symmetrically cultured in science, there is but one opinion as to its value. What is a contrary opinion worth, which is not based upon such culture? Many of our colleges practically ignore science, and graduate young men who know less of it than boys of ten years ought to know and do know in some parts of Europe. Your children labor through twelve years of school life, and after all graduate in worse than Egyptian darkness respecting the most useful of all knowledge, such as all people would use, if they possessed it, every day of their lives.

"It does seem to me strange, to use the mildest word, that people whose destiny it is to live, even for a few short years, on this planet which we call the earth, and who intend to live as comfortably and wholesomely as they can, should in general be so careless about the constitution of this same planet, and of the laws and facts on which depend, not merely their comfort and their wealth, but their health and their very lives, and the health and the lives of their children and descendants. . . .

"But as for mankind thriving by common-sense: they have not thriven by common-sense, because they have not used their common-sense according to that regulated method which is called science. In no age, in no country, as yet, have the majority of mankind been guided, I will not say by the love of

God, and by the fear of God, but not even by sense and reason. Not sense and reason, but nonsense and unreason—prejudice and fancy—greed and haste—have led them to such results as were to be expected—to superstitions, persecutions, wars, famines, pestilence, hereditary disease, poverty, waste—waste incalculable, and now too often irremediable—waste of life, of labor, of capital, of raw material, of soil, of manure, of every bounty which God has bestowed on man, till whole countries, some of the finest in the world, seem ruined forever; and all because men will not learn nor obey those physical laws of the universe which (whether we be conscious of them or not) are all around us, like walls of iron and of adamant—say rather, like some vast machine, ruthless though beneficent, among the wheels of which, if we entangle ourselves in our rash ignorance, they will not stop to set us free, but crush us, as they have crushed whole nations and whole races ere now to powder. . . .

"To those who believe in God, and try to see all things in God, the most minute natural phenomenon cannot be secular. It must be divine; I say deliberately, divine; and I can use no less lofty word. The grain of dust is a thought of God; God's power made it; God's wisdom gave it whatsoever qualities or properties it may possess. Only look at all created things in this light—look at them as what they are, the expressions of God's mind and will concerning this universe in which we live—"the voice of God revealed in facts"—and then you will not fear physi-

cal science, for you will be sure that, the more you know of physical science, the more you will know of the works and of the will of God."—*Rev. Charles Kingsley, of England.*

GENERAL PRINCIPLES

"Our whole system of instruction requires an honest, thorough, and candid revision. It has been for centuries the child of authority and precedent. God intended us for progress, and we counteract his design when we deify antiquity, and bow down and worship an opinion, not because it is either wise or true, but merely because it is ancient."—*Francis Wayland, D.D., late President of Brown University.*

"We display a singular disregard of the plain indications of nature, who herself points out the order in which the faculties should be drawn out into action. We have inverted the natural order just as completely as possible. And this inversion of the order of nature, carries with it the unfortunate consequences that no satisfactory knowledge is acquired at last. —*F. A. P. Barnard, LL.D., President of Columbia College.*

The pioneer of material progress has fought his battle and is victorious. His victory has also made the vanquished truly victorious, for it raises both the 'just and the unjust' into a higher civilization. But the advocate of educational reform has undertaken a more difficult task—more difficult because he

can do nothing without the consent of the public, and the public can overturn his work at pleasure, even just as he is ready to demonstrate its value. With every new victory the progress of science is accelerated; but the power that crushes truth to earth shackles itself.

It will be the object of the next few paragraphs to give a brief outline of the course clearly indicated by the educational science of the present time.

True education is as many sided as the mind that is to receive it; and the mind is as many sided as the sum total of human knowledge. In education there can be but one true method, and that method coincides with nature's tendencies and guides the mind in accordance with the law of its spontaneous evolution.

In the study of the laws of mental development our success must be limited, unless we get at the general law of life by studying the simpler forms of living things. There is one law of development: it begins in the lowest forms of plant life and ends in the physical and mental development of man, becoming more and more complex as it ascends into higher orders of plant and animal life. Nothing in nature stands solitary and alone. Every part of the world is interlaced with every other part, and is more or less dependent upon every other part. Man himself

is linked by visible or invisible chains, with every atom of matter on the globe. He is as intimately connected with the three kingdoms of nature as the tree with the earth and the air which its roots and leaves penetrate; nor can this intimate connection cease for a moment. The unity of nature establishes the unity of science. The unity of science makes the study of education a necessity, and gives a clew to the natural order of mental unfolding.

Man is a product of nature and the culmination of her works; his whole being is permeated through and through by nature's forces and nature's laws. The highest and most valuable knowledge that man can possess is knowledge of himself. Knowledge of himself is the culmination of all science—the great problem in whose solution all science is concerned. The growth of the tree no more depends on the elements of earth, air and water, and the forces of nature that marshal them into life and organization, than man depends upon a knowledge of the whole realm of nature if he would attain to either physical or mental perfection.

We violate the laws of life at every step, and shall continue to do so, until we qualify ourselves to understand them in all their complexity, by the proper study of all classes of objects and phenomena—all the laws and all the forces of nature—laws of matter

and laws of mind. In the volume of nature there are no faults. It is God's perfect text-book for the young and the old of all nations and for all time. Its ample pages are all illuminated with infinite skill, to allure us to the study of the perfect wisdom of the great Author of all. Ignorance of the laws of life confers no exemption from the failure and suffering consequent upon their violation. Nature's inexorable and unpitying penalties are meant to coerce us to the study of her works, when their exceeding beauty fails to allure our attention.

The fatal error in the educational schemes of all ages has been the futile attempt to ornament the mind without informing it; hence the world has but just discovered even the existence of those laws whose violation renders human life so narrow, so full of pain and disappointment. Let us not boast of a high civilization while the lives of half the human race are crushed out before they reach the age of seven years, and not one in ten of the other half makes a successful life of three score years.

The first law of mental development is symmetry. Moreover this law manifests itself in all normal development from the crystallization of the snow-flake, through all gradations of plant and animal life. By what perversity or blindness has the prevailing culture so completely excluded this law till the present

time? In the vegetable kingdom development will not take place at all unless the conditions favor symmetrical development. A grain of wheat is composed of about a dozen elements chemically combined into three classes of compounds. Four of these elementary substances are derived, directly or indirectly, from the atmosphere, and the rest from the soil. If a single element is deficient, the grain will not thrive; and if one element is entirely wanting, not one kernel of wheat will grow, even if all other conditions are most favorable. The food of man, in all its variety, is made up of the same three classes of compounds somewhat extended, though containing very few additional elements. If either the mineral, the carbon, or the nitrogen class were left out of our food for a single month death would be the result. This law extends to the natural growth and unfolding of the human mind. Violated law tells more fatally on childhood than upon age. The result of violating the law of physical development is disease or death, while the violation of the law of mental development stultifies or paralyzes the faculties of the mind.

From the beginning to the end of general education, symmetry is the one essential law; without it, all systems of education will prove a failure. The child just entering school, possesses every faculty, or at least the germ of every faculty, found in the ma-

ture mind. He can observe, remember, compare and reason, but he must do these as a child. He wants ideas, not the signs and symbols of ideas; he wants knowledge itself, for he can use it; but he has no immediate use for the arbitrary signs of knowledge. He delights in the use of his senses; by their exercise he has already learned the most obvious properties, simple relations and uses, as well as the names of all familiar things. He has many thoughts about these things, and has learned how to express them.

Education must be begun and continued as a unit. The first week in school should represent all the great branches of human knowledge — science, language, mathematics and art; not in so many separate lessons or exercises, but all organized, as it were, and as intimately connected as the trunk, roots and branches of a tree. Curiosity and imitation, the natural love of knowing and doing, must both be gratified. One of the chief duties of the teacher is to direct the child how to observe, and where to observe, and how to assimilate and express the result of observation in oral and written language, in mathematical language, and in the language of art.

"In place of this rude and crude, and now happily obsolescent theory, a deeper philosophy is leading us to inquire into the nature of the undeveloped mind, and the true order of the development of its faculties.

. . . I need hardly point out what a change in all our methods this change in our philosophy implies; for it involves the doctrine that the true place to begin the teaching of all art, all science, all knowledge, is the primary school; and I am not in the least afraid of the seeming paradox. Rather I would earnestly maintain that, unless we treat the child in the primary school as the germ and embryo of all he is destined afterward to become, our education will be doomed to ignominious failure. Whatever is to enter into the higher stages of education is to have its seed planted there, or it never will be planted."—*William P. Atkinson, Professor of Literature, Massachusetts Institute of Technology.* (From a lecture at the National Teachers' Association at Elmira, N. Y., 1873.)

The second fundamental law is, that education begins with the concrete and not with the abstract. The child, under nature's tuition, before entering school observes this law, and hence the rapid progress he makes in the knowledge of his surroundings, in language, and in intellectual quickness and clearness; but as soon as he enters school this law is completely reversed; the observing faculties, those natural avenues of knowledge, without which all education would be an impossibility, are suppressed or practically ignored, and the child is treated as if the only road to learning were through the arbitrary signs of ideas. His wonderful intuitive attainments are all overlooked or counted as nothing, and the

teacher begins by superimposing unnatural work in order to enable the child, as quickly as possible, to learn lessons about things instead of learning things as before entering school — he is set to acquiring second-hand knowledge, instead of being directed in the acquisition of real knowledge in a natural way, and as a consequence, his mind becomes vague and abstracted in its tendencies and habits. Books are but one element in true education; libraries alone, cannot make learned men. The best books are read the least, because our education neither gives a taste for useful knowledge, nor the ability to understand the best books.

The third law is, that education begins in the simple and not in the complex. The violation of this and the preceding law has made the study of arithmetic very tedious, and unsatisfactory. The complex and the abstract are so strangely mixed with the concrete and simple, that a large part of the usual course serves rather to confuse and weaken the faculties than to strengthen them.

In the ordinary study of science we begin not only in the abstract, but also in the complex, and violate two laws, at least.

There are mountains so steep they cannot be climbed; others are abrupt on one side, but can easily be ascended from another side, by travelling

up a long, smooth, inclined plane. Thus it is with the sciences. The method in our schools is to try to climb the steepest side of the hill of science, and we slide back nearly as fast as we ascend, mistaking our efforts to climb, for real progress. If we would understand such a complex study as human physiology and the laws of health, we must pass over the inclined plane of all plant and animal life; and in travelling this inclined plane, the learner will find a culture, broad and symmetrical, and full of meaning and interest at every step. Science, language, mathematics, and art are all harmoniously combined in the proper study of the simplest plant. And the reason this method delights the child is because it is the method of nature. He reads at every step the language of the Infinite, and his thoughts are naturally led from "Nature up to Nature's God."

Respectfully submitted,

WM. L. WHITTEMORE,
CHAS. B. TUTTLE,
SUMNER B. EMERSON,
Board of Education